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CONTENTS

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*The editorial work has been undertaken by Mr. Paul Wheatley of the Department of Geography, who has given most generously of his time, enthusiasm and tact to establish the Journal as one benefitting the intention of its inaugurators and the standards of the University.*

*Mr. Lee Kip Lee organized the circulation and put at our disposal his experience as a graduate in business.*

E. H. G. DOBBY

15th August, 1953.



## CONTENTS

	<i>Page</i>
RECENT SETTLEMENT CHANGES IN SOUTH MALAYA . . . . .	1- 8
<i>By E. H. G. DOBBY, B.A., Ph.D., Professor of Geography in the University of Malaya.</i>	
AN OUTLINE OF THE GEOGRAPHY OF THE WESTERN REGION OF NIGERIA . . . . .	9-24
<i>By K. BUCHANAN, B.A., Professor of Geography in the Victoria University College, University of New Zealand.</i>	
RACIAL GROUPINGS IN SINGAPORE . . . . .	25-36
<i>By B. W. HODDER, B.A., University of Malaya.</i>	
THE ECONOMIC GEOGRAPHY OF A ONE-ACRE FARM ON SINGAPORE ISLAND: a Study in Applied Micro-Geography . . . . .	37-48
<i>By J. M. BLAUT, B.Sc., Ph.B., University of Malaya.</i>	
AGRICULTURAL EDUCATION AND RESEARCH IN SOUTH-EAST ASIA: Jottings from the Notebook of a Soil Scientist . . . . .	49-56
<i>By R. L. PENDLETON, Professor of Tropical Soils and Agriculture at the Isaiah Bowman School of Geography, The Johns Hopkins University.</i>	
ABSTRACT: RICE IN SOUTH-EAST ASIA . . . . .	57-58
<i>By E. H. G. DOBBY, B.A., Ph.D.</i>	



# RECENT SETTLEMENT CHANGES IN SOUTH MALAYA

By E. H. G. DOBBY

A paper presented to the *Section on Urban and Rural Settlement* at the *Seventeenth International Congress of the Geographical Union*, held in Washington, D.C., in August, 1952.

JOHORE HAS developed later and less than most Malay states: only 34 per cent of its surface is exploited, chiefly for rubber on estates and small-holdings. But since 1945 the character and pace of its settlement changes have been spectacular.

## EARLY SETTLEMENTS

Prior to 1900 the proportion of Johore in forest was probably 95 per cent; a broad belt of lowland swamp forest lined the west coast and similar difficulties on the east impeded settlement from within and from without.

New settlers in this difficult terrain were water-borne (Fig. 1). From Singapore groups of South Chinese in the last century penetrated Johore along unpeopled rivers which

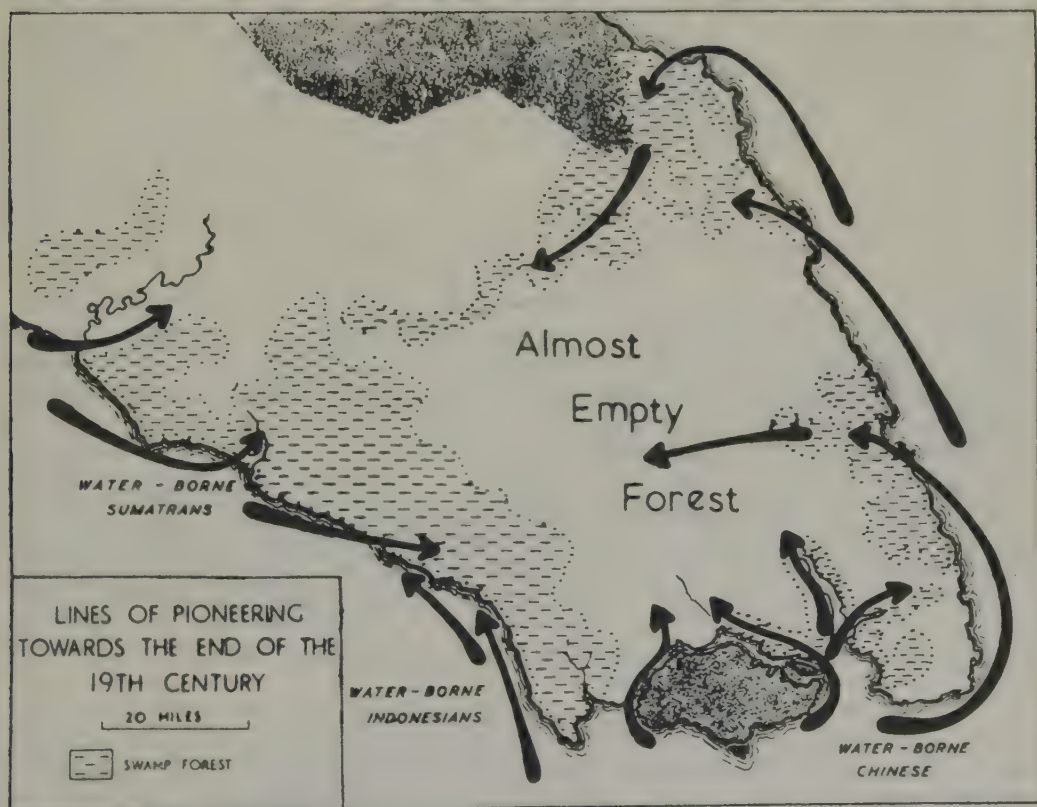


Fig. 1. Routes of Entry of Nineteenth Century Pioneers into Johore State<sup>1</sup>

1. The maps and diagrams in this volume, with the exception of those on pp. 11, 13, 16, 17, 18 and 22, were drawn by Mr. Poon Puay Kee.

opened northwards from the Straits of Johore and from the east coast. Those river-bank colonists have left many place-names which incorporate the Chinese word, *Kangkar*, meaning riverside, e.g. Kangkar Kahang. Organized by methods traditional to Chinese society, each river-group was largely a homogeneous community of one tribe, of Khehs, Cantonese, Hokkiens or Tiechius, located in isolation up-river. They cultivated pepper and gambier commercially: the latter involved boiling and caused a substantial cutting of the forest for firewood. Both pepper and gambier travelled by boat to Singapore markets, whence returned rice, salt and other necessities. The west coast swamps had a peaty soil unsuited to pepper or gambier; into them moved people of Malay stock, settling mainly along the coast which they reached from Malacca, Sumatra and the Rhio Islands. Only slowly and reluctantly did they penetrate the swamps from their fishing-village bases. They cultivated the coconuts which now form large continuous stands extending several miles inland. Though differing in race and economy, both approaches were from the coast and used water transport in and out.

### TWENTIETH CENTURY CHANGES

Because the wet area accessible by these means is not well suited for rubber, Johore was slow to adopt that new land use which began to transform Malaya in the first decade. Rubber cultivation was delayed until the better-drained localities were accessible: hence land transport within Johore in the period 1900–1920 was critical for its development. The north-south railway reached Johore Bahru in 1909. The great triangle of roads linking Mersing, Batu Pahat and Johore Bahru, together with the arterial road from Johore Bahru to Segamat, are less than forty years old. The Johore Bahru-Mersing road, in fact, dates only from 1934. These communications provided routes for pioneers who moved along them by railway and cart to sections of the state never before occupied. Thousands of acres of rubber were laid out astride the land routes through inner Johore, and drew a stream of thousands of Indians to work them. The Chinese pioneer came in by the same means, often planting rubber, always servicing the other settlers, but only occasionally trying food production. Movement off the roads was possible only along beaten-earth roads to plantations or by bicycle along footpaths. The bicycle—"the mule of Malaya"—made rural Johore at that stage accessible, carrying people and supplies inward and bringing pigs, poultry and vegetables out. Johore experienced no tin rushes such as helped populate West Malaya quickly: its iron and bauxite mining became significant very late.

These conditions have made Johore an agricultural state of few people spread thinly (less than 100 per sq. mile). The long-standing Malay settlements were coastal and nearly self-contained; the newer settlers and commercial developments were inland, up-river at first but in greater numbers along the modern lines of transport. Over 90 per cent of Johore people were in units of less than 1,000 each in 1911, and in 1931 85 per cent were similarly scattered. Fig. 2 shows the land use in Johore State at the present time.

### POST-WAR SQUATTERS

The 1941–5 War dispersed more people into the rural areas, but since 1948 about one-third of Johore's rural population has been re-located from a dispersed to a nucleated pattern. The need for re-location arose from the numerous squatters who, in Johore, were people illegally settled on a piece of ground. They were of three types.

(1) On the outskirts of towns squatters had built small, wooden houses for themselves, disorganized, unplanned and insanitary. The squatter and his family in this slum setting were labourers rather than cultivators, or part-time at both.

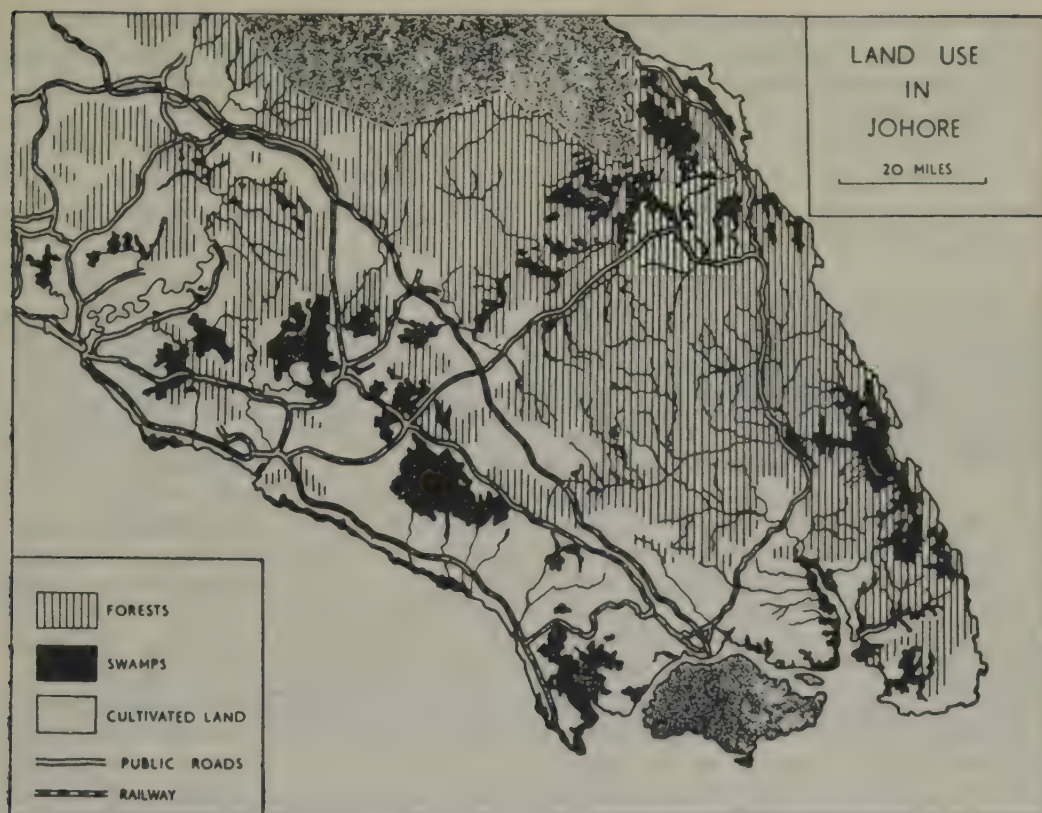


Fig. 2. Cultivated land, forest and swamp in Johore State

(2) Other squatters were within virgin forest, living in wooden houses and cultivating a few cleared acres. They brought new land into use and were true pioneers. Their land was mostly in vegetables and short-term crops, consumed in part by the family and its pigs and chickens, but some going by bicycle to the road and thence to urban markets. This type of forest squatter resulted from a back-to-the-land policy of the war period.

(3) A third group of squatters was on rubber plantations, on land already alienated and in use. At one time these lived much as those in (2), that is, from a clearing in the rubber estate. In the post-war period, such squatters formed a pool of labour and gradually left farming on their own account to work for wages on plantations. They were admirably placed for stealing by tapping part of the plantation. The result of a war-time flight from towns and mines, they combined the modes of living of the other groups.

#### SQUATTERS AND GUERILLAS

When war with Communist guerillas began in 1948, squatters ceased merely to be illegal settlers. Their settlements on town fringes were Communist hide-outs for intimidating urban workers and extorting supplies to support the guerillas. The rural squatters, spread thinly in pioneer margins, without either security of tenure or protection by police, conveniently supplied food for guerillas. Squatter groups on the plantations

became nests of Communists engaged in disrupting labour and rehabilitation. Whether the squatter was coerced or not was a secondary point; it was decided to re-locate all people living outside the urban areas by a mass shift of rural people, squatters and others, to settlements prescribed on military grounds.

#### RE-LOCATION OF POPULATION

The re-location of Johore's population involved two processes, re-grouping, and resettlement.

(1) By *re-grouping* was meant transferring the families and dwellings of labourers from scattered locations in a plantation to a defended point within it. The fortifications consisted of barbed-wire fences enclosing the estate offices, factory and smoke-houses, and the labourers' houses. There always had been some grouping of workers' houses around that focus of plantation processing, but previous planning by the estate management had aimed to distribute the workers to some extent, partly to provide them with a half-acre for their personal cultivation if they wanted it, partly to reduce time in tapping, and to eliminate communal factions where the labour force was racially mixed.

The estate provided a range of social services in any case as an inducement to living on plantations. Under the re-grouping plan, all labour on a plantation was concentrated at one or two points, the nuclei of people, processing, services and shops. Apart from military guidance on defence, re-grouping was under the direction, and at the cost, of the estates, which followed the principles of road development, sewage, water and food supplies they had already established for the efficiency of their labourers, who were in any case normally housed by employers. In Johore, 33,000 workers on estates are Indians: re-grouping these has established large villages of South Indians. Some re-grouping involved shifting squatters on the plantations: these war-time refugees were largely Chinese, totalling (in the 1947 Census) about 43,000. Re-grouping these established a number of villages of Chinese of mixed clans. Altogether re-grouping on estates involved about 80,000 people.

(2) *Resettlement* caused a different shifting of rural people, although its result—nucleating the population—has been similar. It is the compulsory transfer of rural people, whether squatter or legitimate settler, from scattered farms to a fortified area laid out and designed by the state. This military expedient has practically eliminated Johore's dispersed peasant farmer of Chinese origin by withdrawing him from his little hut among a few fields into a town or village, generally sited within a mile or so of the pioneer "log-cabin".

#### TRANSFORMING THE RURAL ECONOMY

Resettlement has, therefore, converted about 100,000 pioneer peasants into towns-people; a total of about 70 towns are to come into existence ultimately. The farmers have brought all their possessions, including chickens and pigs, into the resettlement area. Sometimes it is sufficiently near their old farms to permit daily cultivation but most resettled farmers become wage-earners, particularly during the early phase of building. Each family normally receives, in addition to material for its house, three acres for re-starting vegetable growing in a cleared area adjoining the barbed-wire perimeter, whether inside or outside depending on local circumstances. Where such land is available, it is rarely able to produce without prolonged cultivation during which the farmer's family must find other means of support. At first resettlements appear like shanty towns, their form geometrical, their material wood except for roofing of sheet-iron or aluminium, and their aspect more makeshift than is the intention.

Because resettlement was a phase of military tactics, the planning related chiefly to communications. The new towns are along major roads at points where routes converge, lessening the risk of ambush and facilitating reinforcement and supply. It reflects the overall situation, namely that the military and police depend on road and railway for supplies and movements; the Communists do not use or depend on wheeled vehicles, their milieu is the forest. At first, the new settlements lay astride the roads, with guarded entrances, which meant delaying legitimate road transport. Hence the design was changed to one where the settlement was on one side of the road only and traffic could pass its defended perimeter without impediment.

The military favoured hill locations for resettlement but these are least attractive in soil and water supply, so that a flat landscape well away from high observation points, and yet close to a water supply or stream, has become the commonest location. Flood-light facilities for patrolling the perimeter by night are frequently installed: in the maturer settlements, shops, a meeting hall, a dispensary, a school, post office and market-place are by now established, providing amenities far beyond any available to squatters previously, and all at state instigation and expense.

Resettlement was carried out in 1950 and 1951 by force, though at some points the peasants took the initiative. When the move was treated as a military operation, a whole section of forest was cordoned off by soldiers while the transfer was made: where the scattered people were near negotiable tracks, lorries shifted them within a few hours to a prepared resettlement site. Provided with the materials, peasants mostly built their own huts—as they had done those they were abandoning. The nuisance and hardship of resettlement was a regrettable necessity, compensated by securing for the settlers legal recognition, and by bringing them into the orbit of administration and public services.

#### PEASANT FARMING

Johore's squatters were mostly located in virgin forest where new clearings have soil of a fertility and depth suited to short-term crops. During the Japanese Occupation their dominant interest was growing food: tapioca, bananas, sweet-potatoes, beans and green vegetables were part of their farming system, with pigs as transformers and manure-producers, and with chickens as scavengers. This was the war-time economy of those who fled from towns and from moribund plantations. After 1945, many went back to the towns where the staples of Malayan life, rubber, tin and copra again provided a livelihood. By 1948 there were still in Johore Chinese farming groups totalling about 140,000 people, who had always led an agricultural life, having been either small-holders or workers on rubber, pineapple or coconut estates immediately before the war. These retained that respect for farming which is the only basis for continued life in country areas. It was a socially desirable group likely to stabilize and diversify Malaya.

Between 1945 and 1948 Johore State tolerated this type of squatter and allowed him to produce food in view of irregular external supplies, and by 1950 about 14,000 acres of Johore were in tapioca, sweet-potatoes and vegetables. There had been no post-war mass flight from the countryside and no eviction of illegal settlers. As the machinery of trade was restored, the squatters changed from producing chiefly for themselves to being commercial farmers. From them large quantities of vegetable foods, eggs and pork went by road to the principal towns, to Singapore in the south, and to Seremban in the north. They sold tapioca for industrial starch, pineapples for canning, and pigs. Instead of restricting themselves to their traditional method of intensively developing a small area, the squatters began a robber economy, cultivating a clearing for a short period before abandoning it, and then turning to another. That is, they

reverted to shifting cultivation, damaging thousands of acres beyond possibility of efficient land use for a generation, and leaving them as gaunt scars amid the forest. They had originally needed a local water supply, most readily available at hill-foot locations; these became favoured sites for squatter settlements; thence they pressed back into the hills—provoking erosion—and forward into the swamplier lowlands—disrupting drainage.

#### PROBLEMS OF RESETTLEMENT

Agriculturalists of this type were a problem to resettle. Their isolation made them difficult to round up. Withdrawn into a perimeter of wire, they were unable to practise a kind of farming based on making new clearings whenever soil deteriorated. Only some resettlements were chosen primarily to assure maintenance of agricultural small-holdings. Hence, former squatters became wage-earners on rubber estates or public works, the former tying the settlers into the international politics of the rubber trade, the latter being by nature temporary: both re-introduced the squatter to instability. These measures have reversed the trend towards diversified production and re-emphasized the peril of a slump in rubber.

Disruption of the farm by resettlement, where work for wages was not available, occasionally entailed destitution, with the result that whether or not the squatters had been Communist sympathisers, resettlement gave them a grudge. At Mawai (East Johore) the disruption proved so disastrous that farmers were allowed to abandon the planned settlement.

Resettlement in Johore brought out points relevant to future planning for rural Malaya. On their scattered holdings the squatters depended on streams from hills for domestic water; they dug run-off wells at the foot of the hills; they gravitated to streams for manual watering of their vegetables, which cannot tolerate the day or so of drought common in South Malaya. Confined in resettlement, they had to be supplied with piped water for domestic use and little was available for watering the vegetable fields. Sanitation became a major problem. Within the forest, the problems of human and animal sanitation were minimized by isolation, but contact, and insect vectors in the propinquity of resettlement, produced first-class public dangers, and inoculations were imperative to prevent outbreaks of disease. With animals the situation was different. Pigs were important capital assets of the farmers which, penned in villages, caused a plague of flies, yet their manure was vital to vegetable farming. Ranikhet disease devastated the chickens in confinement, reducing local food supplies and stopping the commerce with Singapore in eggs and poultry. Disrupting the farms thus had consequences outside Johore. In 1951 alone Johore's acreage under vegetables dropped by more than half. The total weight of fresh vegetables moving from Johore to Singapore fell from some 200 tons a month in late 1950 to 30 tons per month in late 1951, causing scarcity-prices and a jump in the cost of living in Singapore.

#### URBANIZING RURAL JOHORE

The squatters had spread from the arterial roads of Johore. Resettlement drew them back to roadsides. The process has transformed Johore's rural population from a dispersed pattern to an urban one. In 1947 the state had only nineteen groups (villages or towns) each with a population exceeding a thousand persons: by 1952 an additional thirty-five settlements of that size had come into being, together with another thirty smaller villages (Fig. 3). Most are strung along the central road from Johore Bahru to

Segamat and northwards: a cluster lies within a ten-mile radius of the rapidly increasing capital, Johore Bahru, to which they are satellites, part of a sprawling conurbation. The new townships are homogeneously Chinese, though of several tribes. In this they are unlike the older towns, where the business community is Chinese and the rest of the population Malay and Indian.

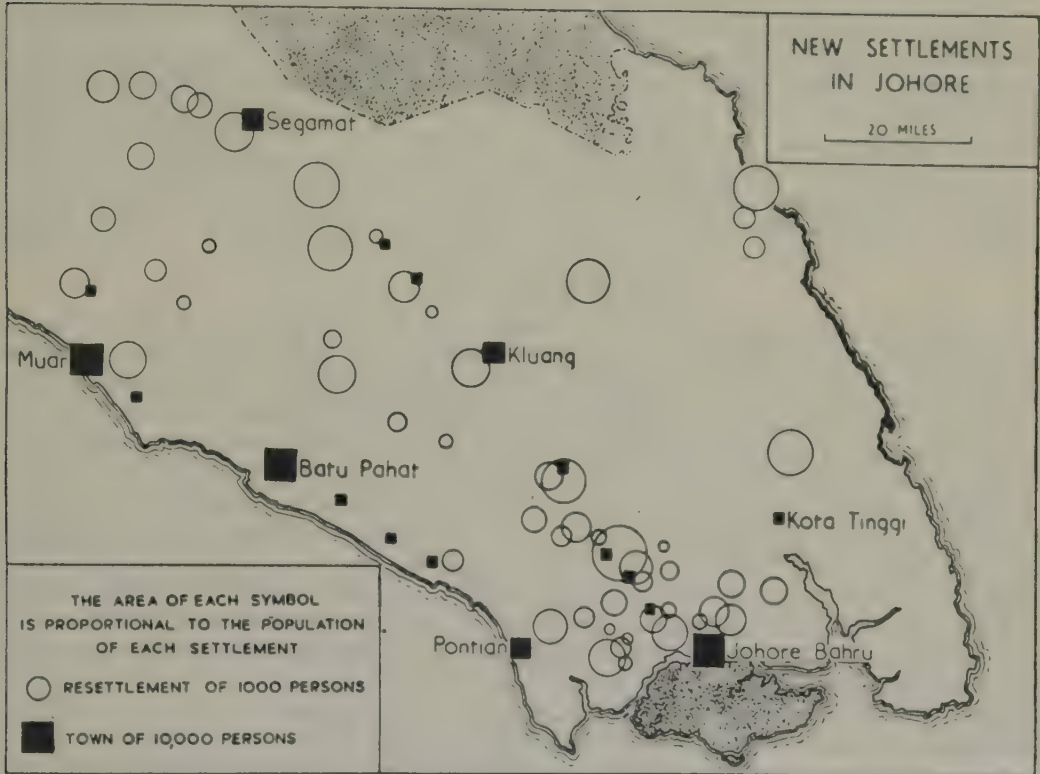


Fig. 3. New Settlements in Johore State

#### EFFECTS ON THE PLURAL SOCIETY

For Johore's plural society the shift of rural population has political consequences. Because the new village councils are largely Chinese, that community acquires a weight which, dispersed as squatters, it never had. The Indians, always fairly compacted acquire no greater voice by re-grouping, but have done so by trade-union organization. Malays, living round the coasts, scarcely touched by resettlement schemes, scattered and remote from the towns, become less apparent than before. Between them and the centres of government, largely manned by Malay officers, is the concentration of Chinese whose resettlement has been the chief preoccupation of governmental policy. These have a superior position for expressing their views, especially as between 1931 and 1947 they increased their proportion in Johore's population. A line roughly midway between the east and west coasts divides the state into distinct parts: in the west, far advanced in transforming the forest into agricultural land, the Chinese exceed the Malays in number and nucleation; the east, still lightly developed and poorly nucleated, has since 1931 changed from a Malay majority to a Chinese one.

Probably resettlement would have happened in any case. The squatting was an effect of war: its continuation was partly inertia, partly realization that rubber is a precarious livelihood. Had real peace come to Malaya, more profitable activities might have eliminated the squatter as he became woven again into commercial life. He was a heritage of war that peace would have had to deal with. Because he was handled speedily and precisely by military action, the normal process of trial and error in the interplay of locational, agricultural and economic values has been omitted. We have to anticipate that while the new towns will tend to remain, the removal of military tension may expose other locational values and cause a change in the proportions, if not the siting, of Johore's urban areas.

# AN OUTLINE OF THE GEOGRAPHY OF THE WESTERN REGION OF NIGERIA

By KEITH BUCHANAN

DURING THE past decade the territory of Nigeria has undergone far-reaching constitutional changes, which have not only gone a considerable way towards meeting the growing demand of Nigerians for a voice in the running of their country, but which have led also to a marked degree of political decentralization<sup>1</sup>. The time is, therefore, opportune for an assessment of the resources and potentialities of these Regions, and it is the object of this essay to outline the geography of the most advanced of the three units, the Western Region<sup>2</sup>.

## (1) THE PHYSICAL SETTING

The physical background of the Region is relatively simple (Fig. 1). There is an interior zone which consists of a dissected peneplain of very old rocks, mainly granites, schists and gneisses<sup>3</sup>. It reaches heights of over 2,000 ft. in the extreme north, and is characterized by a gently rolling topography, broken by occasional long, quartzite ridges and, more frequently, by striking rock domes or *inselberge*; these are especially typical of parts of Ondo and west Oyo. Southwards these old rocks disappear beneath clays, shales and sandstones of Tertiary age, which have weathered into a softly undulating, often featureless, topography with few heights above 600 feet. The third zone consists of coastal alluvium and deltaic muds, and varies in width from some 10 miles in the west to 80 or 100 miles in the Niger Delta region of the east. Except where the larger rivers break through, the coastal bar is practically continuous; good harbours are few and, with the exception of Lagos, the major ports lie well inland along the bigger rivers. A striking feature is the complex network of creeks and lagoons which make possible continuous water communication between the Niger Delta and the Dahomey frontier.

In the south-east<sup>4</sup> rainfall totals are high (60–120 ins.), the wet season is relatively prolonged, and the dominant vegetation is dense rain-forest, giving place in the coastal and delta areas to swamp and mangrove forest. The hostility of this sodden and luxuriant forest is reinforced by soil conditions. Over much of this area the soils are impoverished and highly acid, derived under conditions of intense leaching from young, coarse-textured, sedimentary rocks. They are suited only to an extensive type of land use with long periods of bush fallow, and their extreme acidity is tolerated only by a limited range of economic crops.

In the north-west corner of the Region, in the west of the Provinces of Oyo and Abeokuta, diametrically opposed conditions obtain. Here annual precipitation figures drop below 45 inches, and the dry season is sharp and protracted. Soils are often thin

1. This policy of decentralization contrasts sharply with the centralizing tendencies of the administration during the first quarter of the century. It was initiated in 1939 when the Southern Provinces, formerly a single administrative unit, were subdivided into Western and Eastern Provinces; it was continued by the 1946 constitutional reforms which established in each of the Regions, Eastern, Western and Northern, Regional Houses of Assembly, and it was brought to its logical conclusion by the recent constitutional changes which provide for a federal system of government based upon the three Regions. Each Region now possesses a wide measure of autonomy, unity being secured by a Central Legislature with powers extending to those matters of concern to the country as a whole, such as central finance, external affairs, communications and trade.

2. Consisting of the Provinces of Abeokuta, Benin, Ibadan, Ijebu, Ondo, Oyo and Warri, with the former Colony (Lagos coast strip) now incorporated as the eighth Province.

3. This is known to local geologists as the *Basement Complex*.

4. Approximately south of a line joining Ijebu, Ondo and Asaba.

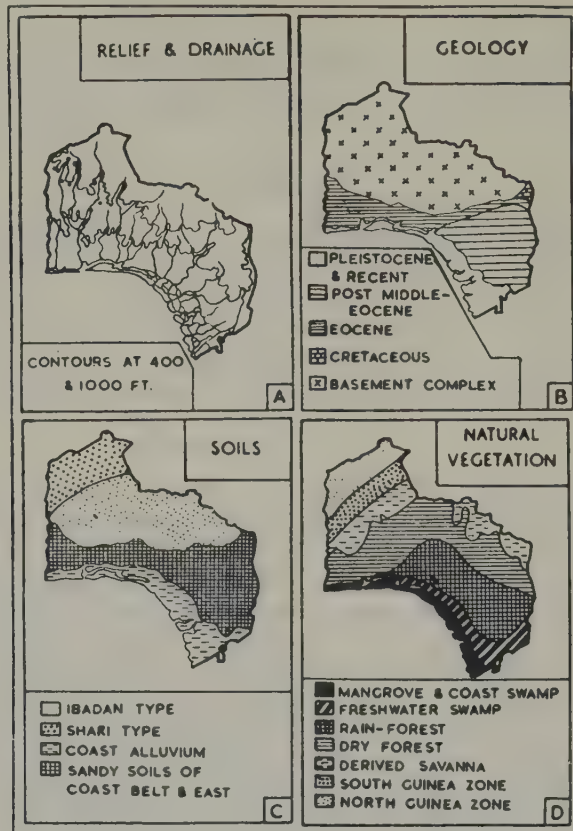


Fig. 1.

- A. Relief and drainage.  
 B. Geology.  
 C. Soil Types. Both the Ibadan and Shaki groups of soils are derived from the rocks of the Basement Complex, but while the former contains a high percentage of deep, loamy or clay-loam soils, the latter is often shallow and sandy, and is less valuable agriculturally. The sandy soils of the coast belt and the east are derived from the sedimentary beds of the coast plain.  
 D. Natural Vegetation. Note the southward curve of the vegetation belts in the western part of the region where they closely follow the isohyets. The *derived savannas* have replaced an original high-forest climax vegetation.

and sandy, thus exaggerating the tendency to drought, and forest gives place to open savanna of coarse grasses and twisted, fire-scarred trees. This corner of the Region has few attractions for the farmer, and it had remained a rural backwater.

It is between the south-eastern rain-forest and this north-western "dry belt" that conditions reach their optimum. Here the dominant vegetation is dry forest, distinguished from the rain-forest by its higher proportion of deciduous trees, its more open formation and its tractable character. The typical soil is the Ibadan type, derived from the ancient rocks of the Basement Complex and possessing reserves of fertility, in the form of unweathered rock minerals, which entitle it to rank among the most productive of Nigerian

soils. It was in the shelter of the dry forest and in the region of the Ibadan soils that the powerful Yoruba kingdoms developed in the past, and it is there that today the most flourishing peasant communities in Nigeria are found.

## (2) POPULATION DENSITY AND DISTRIBUTION

The population of the Region was estimated at 4 millions<sup>1</sup> in 1931, giving an average density of 90 per sq. mile. As Figs. 2 and 3A suggest, this population is very unevenly

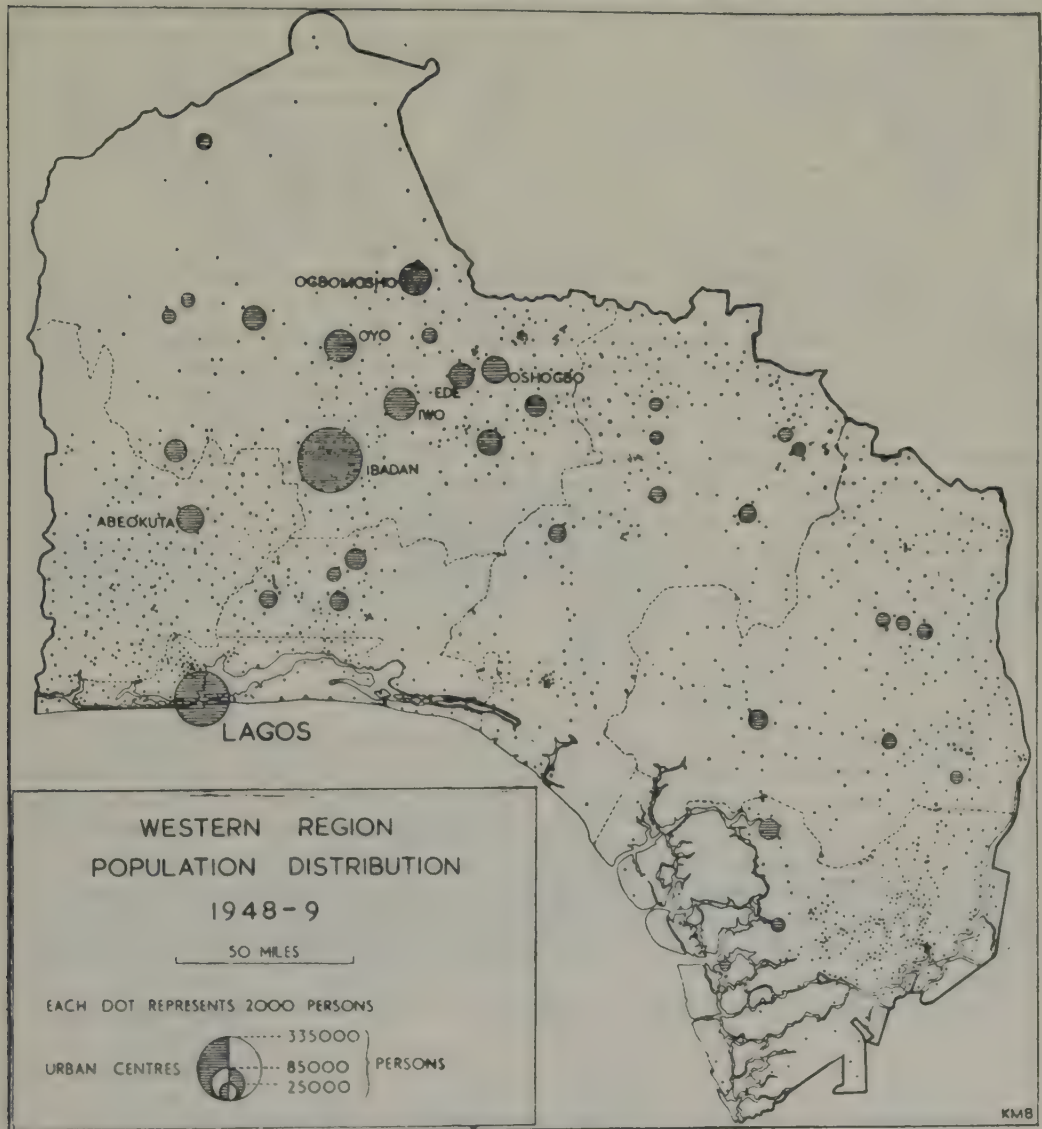


Fig. 2. Distribution of Population in the Western Region. Note (1) the relative emptiness of the north-western dry belt and of the rain-forest (2) the comparatively close concentration of population in the dry-forest zone of Yorubaland, and on the fringes of the Niger delta in Warri Province.

1. This is certainly an under-estimate, as the preliminary results of the 1951 Census give the Region a population of 5.8 millions.

distributed, the pattern reflecting the combined influence of physical factors and of historical factors such as past wars and slave-raiding. The highest densities are found in the cocoa and oil-palm areas of Ibadan Province (218 per sq. mile) with a zone of secondary concentration in the oil-palm area of the extreme east (Asaba division, 168 per sq. mile). Densities drop markedly below the average in the dry belt of Oyo, in the rain-forest zone of South Benin, and in the swamp and lagoon zone of the Delta.

Throughout the Yoruba country settlement is in the form of towns or compact villages, consisting of rectangular, mud houses arranged around a family compound. In the south-east, in the Benin area, the nucleated village gives place to a linear type, with the houses aligned parallel to the road; this linear type is found also in parts of Warri Province, though here the houses are set at right-angles to the road. The settlement pattern of the Ibo country of east Benin is, in contrast, typically dispersed, the individual compounds lying in the midst of their fields so that, in the closely settled areas, there is an almost continuous scatter of farmsteads and little visible break between one village and another. The house-boat villages of some of the amphibious peoples of the Delta introduce a further element of diversity into the rural settlement pattern.

It is difficult to discuss the degree of urbanization of the population for there is no clear-cut line of division between the large village and the town. Many towns lack the basic services and functions which constitute the criteria of urbanization in western Europe, and their populations are dominantly agricultural; such centres are more closely related to the "urban villages" of the Meseta or the Hungarian Plain than to the normal city. If, however, we define our towns statistically and apply the term to all compact centres of over 10,000 inhabitants we find a total of 35 towns in the Region, seven of which have populations of over 50,000 and one of which, Ibadan, with a population estimated at 335,000, ranks as the biggest city of Tropical Africa (Fig. 3B). On this basis 30 per cent of the population is urban-dwelling, the highest proportion of town dwellers being found in the Yoruba Provinces (Ibadan Province 68 per cent). Outside this zone of urban concentration towns are fewer in number and smaller in size, and some, as in Warri Province, owe their existence largely to European influence.

### (3) RACIAL AND CULTURAL GROUPS

Though little work has been done on the physical anthropology of the Region even the most casual observer cannot fail to be impressed by the very great diversity of physical types encountered. The basic stock is negro, but the frequency of brown or even light-brown skins, and of relatively finely-cut features (especially among the Yoruba women and coastal groups such as the Jekri) suggests dilution with non-negro types. These are of problematical origin, though the geographical distribution of non-negroid features seems to lend support to the hypothesis of an infiltration of Mediterranean (i.e. Fulani) racial elements from the North, and an admixture with sea-borne European elements along the coast.

According to the 1931 Census the importance of the major tribal groups was as follows:—

		<i>per cent</i>			<i>per cent</i>
Yoruba	...	70.6	Ijaw	...	1.1
Edo (Bini)	...	14.4	Others	...	6.9
Ibo	...	7.1			

Since this census migration towards the towns has altered the pattern in detail, but the broad picture given above is correct in essentials. Details of tribal distribution are given in Fig. 3C. It will be seen that there is a marked contrast between the four western Provinces, which are overwhelmingly Yoruba, and the remainder of the Region,

where non-Yoruba groups such as the Edo, Ijaw, or Ibo predominate. Each of these major groups is divided into sub-tribes differentiated by slight dialectal or historical differences<sup>1</sup>.

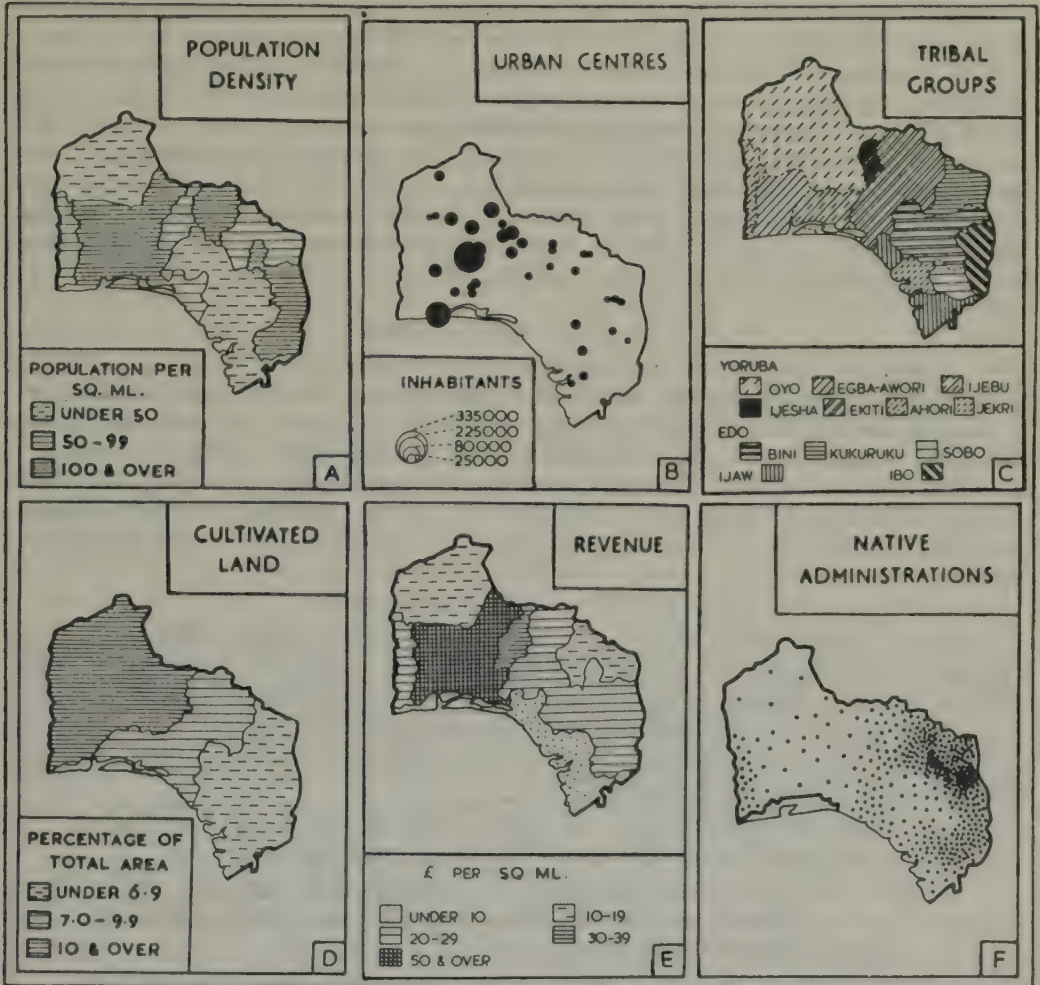


Fig. 3. The Human Pattern in the Western Region. These maps focus attention on the duality of the region, and emphasize the contrast between the highly cultivated, urbanized, and politically well-developed Yoruba Provinces on the one hand and the rest of the region, with a less developed agriculture, a relative absence of large urban centres, and a complex pattern of small and comparatively poor Native Administrations, on the other.

A. Density of Population.

B. Urban Centres.

C. Tribal Groups.

D. Cultivated Land.

E. Revenue.

F. Native Administrations in 1946. Each dot represents one Native Administration or Sub-ordinate Native Administration.

1. It is not possible to discuss the numerical significance of the various religious groups owing to lack of census data. Over much of the West, however, the population is basically animistic. Islam, in a somewhat diluted form, is important, and appears to be making converts in the open savannas of the north-west, but is relatively unimportant in the high forest country. Christian, and especially Catholic, influence is strongest in the towns and notably in those areas, such as Benin and the Delta, which have had relatively long contacts with Europe. In these two latter areas Christianity was introduced by the Portuguese in the fifteenth century: it did not, however, take root and the existing Christian communities are of more recent origin.

Economically, the bulk of the population, probably some 80 per cent of the total are peasant farmers and craftsmen, and, except in the port of Lagos, a land-divorced urban proletariat has as yet scarcely appeared. But the impact of Western methods of government and of education, and the development of export production, have called into being an important and growing middle class<sup>1</sup>. There is thus emerging the beginnings of a system of social stratification cutting across the old tribal and religious boundaries, and this development is perhaps more evident in Yorubaland than in any other part of Nigeria. The non-African groups in the Region are insignificant numerically and are essentially transients, but they play a vital role in the political and economic fields. The total European population outside the Lagos area is less than 2,000; of this total, over two-fifths is concentrated in the administrative and educational centre of Ibadan. "Other non-natives" total 350, of whom two-thirds are to be found in Ibadan; this group consists largely of Syrians and is concerned almost entirely with trade and commerce.

#### (4) POLITICAL ORGANIZATION

A broad picture of the political organization of the Region in 1946 is given in Fig. 3F. At that date the Region was partitioned between some 400 Native Administrations or Subordinate Administrations<sup>2</sup>. In recent years changing social and economic conditions have brought about some modification of the picture given in Fig. 3F. Federation has reduced the number of Native Administrations in the east, producing larger and stronger units of local government, while in the Yoruba Provinces a policy of decentralization has created subordinate administrations in closer touch with the people they serve.

#### (5) THE AGRICULTURAL ECONOMY

Because of past Government policy plantations are of negligible importance in the Region, and agriculture is based on African peasant production carried on by hand methods under traditional forms of land tenure. The establishment of law and order under the British, the improvement of communications and the growth of urban demand, all stimulated cash-crop production, and today it is possible to distinguish three elements in the Region's agricultural economy:—

- (1) A basic subsistence economy which attains its maximum importance in the relatively inaccessible areas of the north-east and north-west.
- (2) An exchange economy producing, for exchange with other areas of the Region or of Nigeria, surplus foodstuffs and more specialized commodities such as palm-oil and kola nuts.
- (3) An export-production economy centring on cacao, palm-oil and rubber.

All degrees of combination between these various economies are to be found in the Region.

Agriculture is carried on everywhere under a system of bush fallowing. Selecting an area of forest or bush, the farmer clears the undergrowth and cuts off the smaller trees and shrubs some two or three feet above the ground. Useless trees are killed by piling the slash around their base and burning. The plot is cultivated for one to three years and it is left fallow for a period of five to ten years, during which the bush regenerates. Unfortunately, with increasing population and with an increase in the area under cash

1. This includes both professional groups such as doctors, lawyers and civil servants, and commercial groups such as contractors, middlemen and merchants. These have taken over many of the forms of European society, supply much of the drive for the new nationalism, and exercise an influence out of all proportion to their numbers. Below this group is a lower middle class group, including the lower rank government employees, the shop assistants and the small middlemen and dealers; here the degree of westernization is much less.

2. The average area of each was thus some 110 sq. miles, with a population of 11,000. In the Yoruba Provinces and West Benin, however, the average area was 198 sq. miles, as against 58 sq. miles in the rest of the Region. Average populations for these areas were, respectively, 17,000 and under 5,000.

crops, the period of fallow is reduced; the natural bush or forest does not have an opportunity to regenerate and the exhausted land is invaded by speargrass. This may be observed around many of the bigger towns and in the closely settled Western Ibo country.

Hoe cultivation is universal and crops are grown in mixed culture, either on mounds or on ridges with cross balks. The dominant crops are yams and cassava, with maize, plantains, sweet-potatoes, pumpkins and a wide range of vegetables. In addition, millets and guinea corn make their appearance in the north-western dry belt, while rice is a crop whose popularity has increased enormously in the high forest country in recent years. Live-stock are of limited importance and, owing to the prevalence of trypanosomiasis, the larger types of stock are rarely found outside the dry savannas of Oyo Province. Elsewhere the dwarf *muturu* cattle, which appear to possess some degree of tolerance to trypanosomiasis, occur in small numbers, but are of negligible importance. The virtual absence of cattle has far reaching socio-economic consequences: mixed farming can make little headway; transport away from the roads must depend on human carriers; the absence of milk and the shortage of animal protein leads to multiple nutritional deficiencies. It is true that the Region possesses an estimated 100,000 haired sheep and over 250,000 goats, but these, like the flocks of poultry, are regarded mainly as a source of income and are usually eaten only on ceremonial occasions.

The chief commodity produced for the internal market is kola nuts, which are chewed as a stimulant throughout West Africa. These are grown on a large scale in the south of the Cocoa Belt, where kola has tended to replace cocoa on the lighter soils. No data exist on either the number of trees or the acreage under the crop, though some measure of its importance may be obtained from the tonnages handled by the railway. In 1948 some 47,000 tons, worth between £5 and £7 million, were railed to the Northern Region, and these figures, it should be stressed, do not take into account the very considerable quantities handled by motor transport. Cotton is another crop grown for the local market, chiefly in the drier areas such as Oyo Province and north-east Benin. Before World War II there was a small overseas export (e.g. 8,500 bales in 1935), but export prices have not been attractive in recent years and the bulk of the production now goes to local weavers. Chillies and tobacco are also grown in the drier northern areas. The tobacco includes both native types and a higher quality product grown in West Oyo for the Nigerian Tobacco Company's factory at Ibadan.

The major export crops are cocoa, palm products and rubber, accounting respectively, for 57, 30 and 2 per cent of the Region's overseas exports.

Cocoa production in recent years has varied between 90,000 and 100,000 tons. The bulk of the production comes from the south-west of the Region, and the crop finds its optimum conditions on the better soils of the Ibadan type (Fig. 4B). It is absent from the north-west owing to low humidity, while to the east of Ondo the increasing acidity of the soils and the prevalence of capsid under conditions of high rainfall rule out large-scale cultivation. Preliminary figures suggest a total of half a million acres under the crop, divided between 320,000 farmers, and on this basis some three-fifths of the population of the Yoruba provinces are directly dependent on cocoa as their major source of cash income. As a result of excessive concentration on this crop many areas are no longer self-supporting in basic foodstuffs and the agricultural system of the Cocoa Belt has become increasingly and dangerously unbalanced. The recent spread of swollen shoot disease, under these conditions strikes at the very foundations of the West's prosperity; should the present control campaign fail, a drastic re-orientation of the Region's economy will be inevitable and the selection of possible alternative crops becomes a matter of highest priority.

Palm products, kernels and oil, represent the second great export crop, the 163,000 tons of kernels and 26,000 tons of oil accounting for respectively 47 and 15 per cent

of Nigeria's exports of these commodities. In addition, a considerable volume of oil is consumed locally<sup>1</sup> and there is a small export to the Northern Region. The kernels are collected from semi-wild trees, yields are low, and at a figure of 6 lb. per tree, the Region's kernel exports would represent the production of some 60 million trees. Two main producing areas may be distinguished (1) an eastern area on the acid sandy soils of Benin and Warri, which represents a continuation of the main Palm Belt of the Eastern Region, and (2) a western area overlapping the Cocoa Belt in the Provinces of Ibadan, Ijebu and Abeokuta (Fig. 4c). Much of the oil is extracted by relatively primitive hand methods, though manual presses are increasingly used, and a beginning has been made with fully mechanized extraction in mills. These mechanized extraction processes give not only a higher extraction rate<sup>2</sup>, but also a higher grade oil.

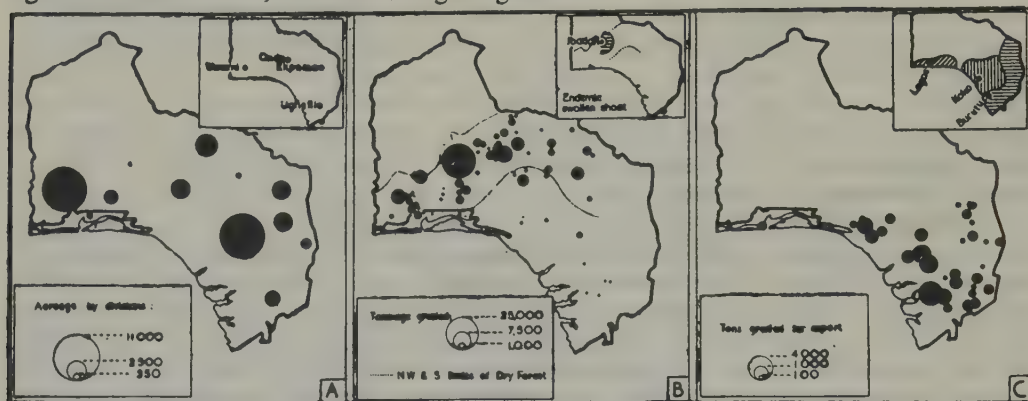


Fig. 4.

A. Rice production (by divisions). Inset: location of rice mills.

B. Cocoa production (by tonnage graded). Inset: area where swollen shoot is endemic.

C. Palm-Oil production (in tons graded for export). This excludes oil consumed locally. Inset: bulk oil-plants and their tributary areas.

These maps show that the duality within the region is also evident in its agriculture. The dry-forest zone of the west with its deep loamy soils is the main cocoa area, while palm produce is the major export on the leached soils of the rain-forest zone.

Rubber is produced on a small scale on the southern fringe of the rain-forest in the Provinces of Benin and Warri. Of the total production (12.2 million lb. in 1948-9), 13 per cent came from three large estates in the Sapele area, and most of the remainder from small growers who interplant their yams and other food crops with rubber. Especially on these smaller-holdings little attention is given to the crops, trees are rarely thinned and tapping methods are careless. Yields, in consequence, are low with an estimated maximum of 200 lb. per acre.

A broad picture of the place of the west in the agricultural export economy of Nigeria, and of the degree of development of various sectors of the Region, can be obtained from the analysis, on a value basis, of export statistics for the main agricultural commodities. The output of the three Regions in 1948-9 is summarized in Table I.

TABLE I. ESTIMATED VALUE OF AGRICULTURAL EXPORT PRODUCTION

Region				Estimated value in £ million sterling	Value per head in £'s sterling	Value per sq. ml. in £'s sterling
West	...	...	...	10.9	2.5	242
East	...	...	...	7.3	1.4	159
North	...	...	...	9.75	0.72	34

1. The volume is difficult to estimate but may be as high as 100,000 tons.

2. The oil mills give an extraction rate of 95 per cent as against 55 per cent by traditional hand methods.

Thus the west accounts for almost two-fifths of the country's agricultural exports, its output per unit area being almost eight times as great as that of the north, and *per capita* almost three times as great as that of the remainder of the Territory. There are wide contrasts between various parts of the Region in the degree of development of export production. As would be expected, highest outputs are to be found in the Cocoa Belt<sup>4</sup>, with a secondary centre in the coastal palm belt of Warri, and lowest outputs in relatively inaccessible areas such as north-east Benin<sup>2</sup> and Oyo<sup>3</sup>. Estimates of *per capita* output give a somewhat similar ranking, with figures of over £5 for most parts of the Cocoa Belt<sup>4</sup>.

Fig. 5 shows the land-use regions of the Western Provinces.



Fig. 5. Land-Use Regions of the Western Provinces. (1) The zone of coastal swamps and swamp-forests. (2) Forest Reserves: *a*. the high-forest reserves of the humid south, *b*. the savanna reserves of western Oyo. (3) The cocoa and oil-palm region of Yorubaland, producing basic root crops (yams, cassava) and maize, and with a highly developed export production of cocoa and palm kernels. Rice is important locally. *a*. Kola sub-region. (4) The cocoa belt of Ondo. Export production is less highly developed than in region 3, with palm products relatively unimportant in the export economy. (5) The palm belt of eastern Benin. This is essentially an extension of the main palm belt of the Eastern Provinces and is characterized by the large scale production of palm oil for export. (6) The Benin-Wari rubber region. *a*. mainly peasant production, *b*. estate production. (7) The subsistence-crop region of north-eastern Benin, characterized by the production of the basic food crops of the high-forest zone, including the oil-palm; and by a relatively undeveloped export economy; but with a surplus of food crops for internal trade. (8) The subsistence-crop region of north-western Oyo. This is a thinly-peopled savanna country, producing the basic southern food crops, supplemented by guinea corn and millets; and with a small-scale production of tobacco and chillies, and with some cattle.

1. Egba Division £750 per sq. mile, Ife-Ilesha £580, Ibadan £480.

2. Kukuruku £22 per sq. mile.

3. £1 per sq. mile.

4. But the great concentration of population in Ibadan results in the relatively low figure of £2.2 for Ibadan Province dropping to less than one shilling in Oyo Province.

## (6) FOREST RESOURCES

The forest areas play an important role in the economic life of the Region, not only as important contributors to the export trade, but also as a source of many of the necessities of everyday existence. Timber exports, which were insignificant before World War II, exceeded £1 million for the first time in 1948, representing 7 per cent of the Region's overseas exports. In the internal economy the forests are of major importance as a source of fuel, the market value of the firewood consumed in the Region being, at a conservative estimate, between £750,000 and £1 million. In addition, the forests furnish a wide range of foodstuffs and of raw materials for peasant industries. They supply material for rope, fibre bags, nets and mats; oils and fats for cooking and lighting, and charcoal for metal-working; materials for house-building and food-wrapping; dye-stuffs and a vast profusion of drugs and medicines; honey, food plants, edible snails and small game. It is impossible to assess the value of these forest products; they are, indeed, to be numbered among the essentials of daily life and the progressive depletion of forests in closely settled districts leads to a general improvement of the whole peasant economy.

Forests, including in this category "uncultivated wasteland", covered 18 per cent of the Region in 1944. They attain their maximum importance to the east of the Cocoa Belt and north of the delta, i.e. in the Provinces of Ijebu, Ondo and Benin, where they cover over two-fifths of the surface (Fig. 6A). A more reliable index of the extent of commercial forests is given by the distribution of Forest Reserves (i.e. areas in which lumber production is dominant and which are exploited on a controlled basis). These cover 13 per cent of the Region and form a continuous belt across the high forest zone from Ijebu to east of Benin City (Fig. 6B).

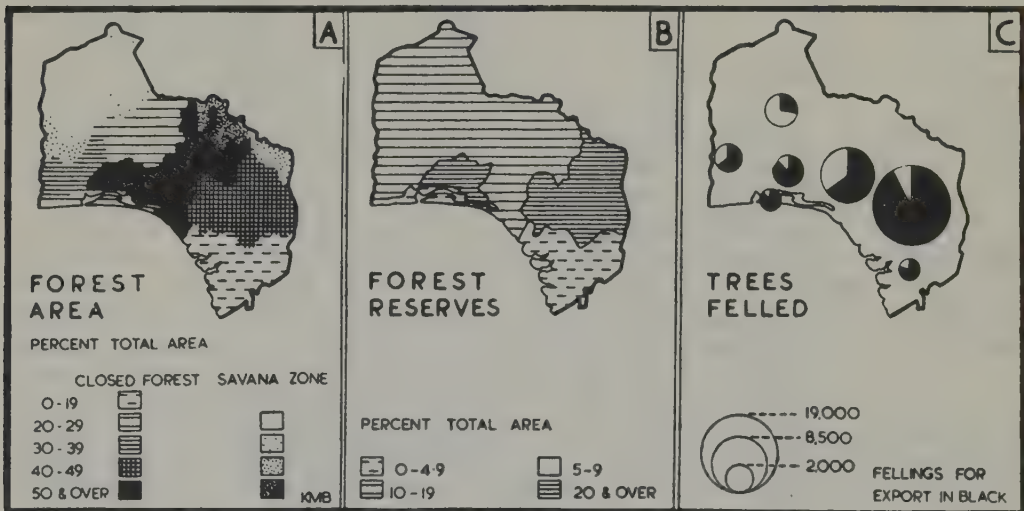


Fig. 6.

- A. Forests as a percentage of the total area.
- B. Forest Reserves as a percentage of the total area.
- C. Trees felled. Note the concentration of felling in the rain-forests of Benin Province.

The Western Region dominates the forest economy of Nigeria, accounting for virtually the entire log output, for seven-tenths of the sawn timber, four-fifths of the total value of timber produced, and for 99.5 per cent of Nigeria's timber exports. The greatest contribution to this output is made by the rain-forests of Benin and the adjoining

Provinces; in 1948-9 Benin Province alone accounted for 83 per cent of the trees felled in the West, Ijebu for 9 per cent and South Oyo (as it then was) for 8 per cent (Fig. 6c). This great development has been favoured by the wealth of economic species in these western rain-forests and by ease of water communications; in both these respects the Region enjoys marked advantages over the Eastern Region. Expansion in the last few years has been rapid and has been made possible by fuller utilization of the forest, by improved handling techniques based on a wider use of machinery, and by better communications, while the growing maturity of the industry is indicated by the establishment of a large-scale plywood and veneer plant at Sapele, on the southern margin of the Benin rain-forest.

#### (7) THE INDUSTRIAL ECONOMY

Though modern large-scale industry is as yet of very limited importance, peasant craft industries play an important role in the regional economy. This is especially so in the remoter areas where European trade goods have not penetrated on a massive scale, and here almost every compound has its craftsmen or women working up local or imported materials into items of everyday need. In the bigger towns, too, these local crafts are still important, though here they are supplemented by forms of industrial activity which have developed as a result of the specialized needs of urban society, such as motor engineering, or by luxury crafts such as goldsmithery or photographic work. It is unfortunate that no adequate statistical material exists covering these forms of economic activity and the account given here must therefore be largely descriptive.

##### (i) *Textile and clothing industries*

In spite of several decades of competition from European piece-goods the cotton textile industry is still one of the most flourishing and widely distributed of the Region's peasant industries. In normal years it absorbs virtually the entire regional output of cotton. At present, the limiting factor in the expansion of the industry is yarn production and it is consequently unfortunate that the results so far achieved from the introduction of new methods of spinning have been limited; on the other hand, the training of broad-loom weavers has been more successful, and the output of broad-loom cloth is rapidly expanding. The great bulk of the Region's cloth output, however, still comes from the indigenous narrow loom, producing narrow strips which are sown together to make cloth of the desired width. Narrow-loom weaving is carried on entirely by men; the dyeing industry, by contrast, is in the hands of women, who use both vegetable and synthetic dyes, and produce a wide and pleasing range of designs by both the "tie-up" and *adire* (*batik*) processes.

The clothing industry uses both local and imported cloth and is very widely distributed. Every village of any size will boast at least one tailor, while in the bigger centres tailors are the most widely diffused and numerous of all industrial workers; a reconnaissance survey of Ibadan gave a total of over 900 tailoring establishments, representing one-third of all industrial units mapped.

The miscellaneous fibre industries may be included here; one of the best examples is the mat industry of the Ekiti district of Ondo, which uses as raw materials the so-called "Yoruba soft canes".

##### (ii) *Food processing industries*

As might be expected in an area whose economy is still dominantly agricultural, the preparation and processing of foodstuffs is a major branch of economic activity. Included under this heading are such diverse activities as the preparation of *gari* from cassava, corn-milling and rice-milling, and the expression of oil from the palm fruit. It is only for this latter branch of the industry that even approximate data are available.

Over nine-tenths of the Region's palm-oil production<sup>1</sup> is produced by hand methods without even the simplest machinery. These hand methods are excessively time-consuming and wasteful, giving an extraction rate of not more than 55 per cent, and a great improvement is obtained by the use of simple hand presses. These handle up to 1½ cwt. of fruit at a time and give an extraction rate of 65 per cent; they have increased markedly in popularity in recent years and in 1949 there were 93 of these presses at work, chiefly in the eastern sector of the Palm Belt.

### (iii) *Metal-working industries*

Two groups of traditional metal industries may be recognized: the working of non-ferrous metals such as brass or gold, and the iron-working and sheet-metal industries. The former, which includes the production of jewellery and ornaments and brass-founding, are essentially luxury industries and are concentrated in the bigger centres. The city of Ibadan, for example, contains over 100 goldsmiths' shops and brassworking establishments. These industries attain their highest degree of technical perfection in Benin City; here brass working by the *cire-perdue* method has a long history, and the best of its products rank among the outstanding achievements of West African craftsmanship.

Iron-working and associated metal industries rely largely upon imported raw materials in the form of metal scrap and, since they cater for the everyday needs of the rural community, they are widely diffused. Hoes, knives, machetes and other articles of domestic or agricultural use make up the greater proportion of the Nigerian blacksmiths' output, while a small-scale sheet-metal industry, producing lamps and articles such as medicine containers, is found in some of the bigger centres.

With the development of modern methods of transport many metal workers have adopted cycle- and motor-repairing as a supplementary or even major activity, and these activities provide a significant volume of employment (one-eighth of all industrial units in Ibadan). Even more important is the opportunity they provide for a growing number of workers to acquire the rudiments of mechanical skill without which the future development of secondary industry would be impossible.

### (iv) *Wood-working industries*

Like metal-working, these industries fall into two broad groups: the first and most extensive group produces domestic furniture based largely on European models, the second produces traditional objects such as masks and figures. The former group is found in all the bigger centres; in Ibadan, which may be taken as typical, there are some 480 wood-working establishments (a number exceeded only by that of tailors), many of which employ half a dozen or more workers. The traditional wood-carving industry, using local ebony, has received a new lease of life as a result of a growing European demand for its carved heads, panels and statuettes.

### (v) *Other industries*

The leather-working industry is represented chiefly by sandal-makers, using local hides and skins, and, increasingly in recent years, old motor tyres for soling, and by the multi-coloured leather work of Oyo. The only other industry of any significance is pottery. Owing to the competition of European hollow-ware (and, to a lesser extent, of pottery imported from outside the Region, e.g. from Ilorin) this is most important in the economy of the remoter districts.

1. Probably of the order of 125,000 tons.

Superimposed on this background of peasant crafts are the newer industries based on European techniques and concerned largely with the processing of agricultural or forest products. The rice mills operated by the Department of Agriculture and the Pioneer Oil Mills<sup>1</sup> established by the Department of Commerce and Industries are small scale examples of such processing industries. On the larger scale are the fruit-juice factories at Agege and Abeokuta, the fruit cannery at Ibadan and the Nigerian Tobacco Company's factory at Ibadan; in addition, Lagos has a brewery and miscellaneous food-processing and food-packaging industries. In the textile industry, large-scale production has been initiated by a sixty-loom factory on the outskirts of Lagos; this will have an annual output of 1,872,000 yards of cloth, manufactured from imported yarns, and will supplement existing small-scale power-loom establishments in Ilaro, Ijebu, Ode, Abeokuta and Lagos itself. Finally at Sapele, on the seaward margin of the Benin rain-forest, the United Africa Company's recently established plywood and veneer factory marks the beginning of a large-scale timber-processing industry in the West.

#### (8) COMMUNICATIONS

Transport has many difficulties to overcome in the West; roads are expensive to construct and difficult to maintain owing to geological and climatic conditions; the great river thoroughfare of the Niger on the eastern boundary suffers from a highly seasonal regime and constitutes a serious barrier to inter-regional traffic; the interior is cut off from the sea by a triple barrier of surf, sandpits and swamp. It is against this background that the communications pattern should be viewed.

The total road mileage is 5,590 miles, giving a density of 12.2 miles of road per 100 sq. miles of area. The density drops markedly below this average in the deltaic zone of Warri Province and in the under-developed zone of Oyo Province, while the dense rain-forests of South Benin break the continuity of communications across the south of the Region. Of the total mileage only 460 miles are tarred; the remaining roads are laterite or "dirt", and liable to "cut up" and become badly corrugated with the heavy seasonal traffic of the Cocoa Belt.

The Region is served by a single-line railway running from Lagos, via Abeokuta, Ibadan and Oshogbo to the North (Figs. 7A and 7B). This line is one of the main channels for the evacuation of the Northern Region's groundnut crop and, with a line capacity of only four or five trains a day in each direction, has been severely overtaxed by the expanding volume of groundnut traffic in the last decade. Partly as a result of the priority accorded to this traffic, the line is of only limited significance in the local export economy, the bulk of the cocoa and palm kernels being handled by road traffic. Northbound railings include bulky imports, such as petrol received through Lagos, and there is also a considerable traffic in kola nuts.

Water communications are provided by the Niger and by the creeks and lagoons of the coast belt. The waterways not only play an important role in the evacuation of local produce, they also act as outlets for a considerable proportion of the tin, groundnuts and benniseed of the North. The coastal lagoons are navigable for vessels of 4 ft. 6 in. draught from the Niger Delta to Lagos; they are especially important in the western sector for much of the cocoa from South Ondo and Ijebu is sent by road to Okitipupa or Ejinrin, and thence by lighter along the lagoon to Lagos. The Niger, as already noted, suffers from a highly seasonal regime. During high water (August–October) vessels of thirteen-feet draught can reach Lokoja; in March, April and May the maximum draught to Lokoja is 1 ft. 6 in., and Onitsha is the effective head of navigation.

1. 41 are projected; these will have an annual output of some 15,000 tons of oil.

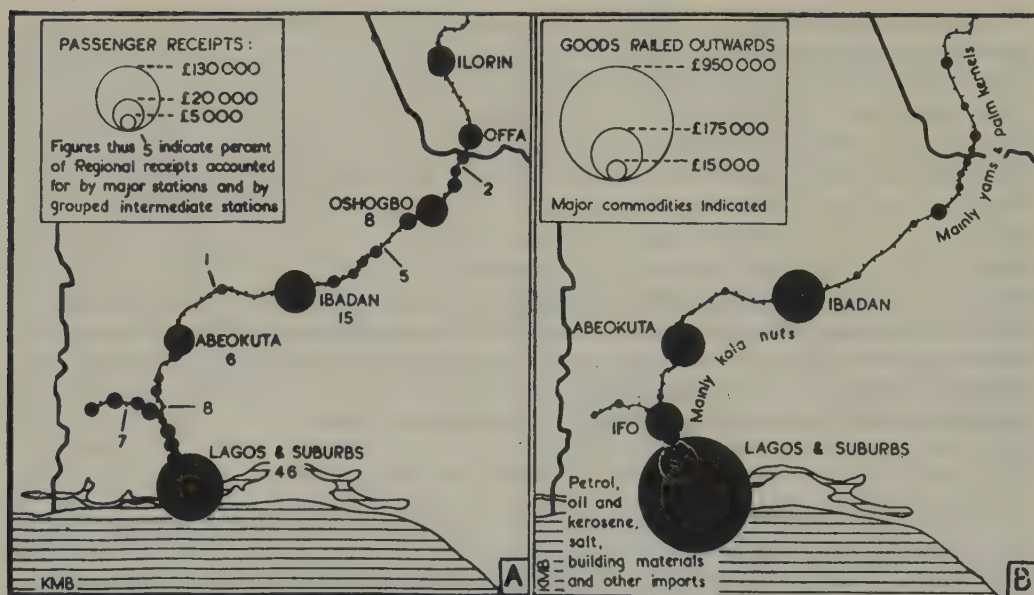


Fig. 7. Rail Traffic in the Western Region.

A. Passenger receipts. B. The seaward movement of commodities.

Apart from a small volume of land and water traffic across the western frontier to Dahomey, the Region's trading relations with the outside world are via the port of Lagos and the so-called Benin ports: Warri, Sapele and Burutu. In addition to handling locally-produced cocoa and palm produce, these ports, and especially Lagos, are the outlets for the greater part of the export trade of the Northern Region. Through them passes four-fifths of the groundnuts trade and nine-tenths of the hides and skins trade. The major features of the trade of these ports are summarized in Table 2.

TABLE 2. THE PORTS OF THE WESTERN REGION: 1948

—	Tonnage handled	Imports in £'s sterling	Exports in £'s sterling	Northern Region Exports as Percentage of Total
Lagos ... ..	1,167,206	29,490,358	23,346,310	39
Sapele ... ..	125,204	927,053	1,612,950	—
Warri ... ..	35,795	1,366,646	326,833	49
Burutu ... ..	81,400	928,613	950,617	15

The dominance of Lagos is clear, and this has become increasingly marked during the last decade as a result of the silting of the Benin ports; because of this a growing proportion of the exports of the Benin ports is conveyed by shallow-draught coasters to the deep-water port of Lagos, there to be transferred to ocean-going vessels.

### (9) THE FUTURE

Economically no less than politically, the Western Region has reached a critical stage in its development.

As in many African territories its population appears to be entering a stage of rapid expansion, in the face of which the fullest use of its land resources is essential.



Fig. 8.

View across the peneplain of Western Oyo, looking westwards towards the Dahomey frontier. The general level is 8-900 feet with traces of a higher surface in the background. The skeletal soils of the hill in the foreground are under cultivation; and beyond are the savannas of the Guinea Zone.



Fig. 9.

A village in the south-west of the Coast Belt. The absence of clays suitable for use as building material in the sandier parts of the coast plain encourages the use of palm ribs. Note the compounds enclosed with palm-rib fences, and the coconut palms in the background.



Fig. 10.

A clearing in secondary bush in the Dry-Forest Zone of Abeokuta Province. The undergrowth has been felled at knee-height and is drying before being burnt. The larger trees and palms have been left standing.



Fig. 11.

Young cassava on the intensively cultivated coast sands in the western sector of the Colony. The original vegetation has been almost entirely replaced by cultivation, oil-palm bush or grassland.

The population map reveals a very uneven pattern of distribution, and while some areas are empty because of adverse physical conditions, others are thinly peopled because of historical factors. These latter areas—and parts of West Oyo are typical—occupy a critical place in any programme of population redistribution.

The expansion of population (with rising living standards), and the threat to the whole export economy presented by the spread of swollen shoot disease, make the agricultural future far from bright. The conservatism of many members of the cocoa-farming community has impeded the progress of rapid and drastic counter-measures to check the spread of the disease; and this same conservatism, together with the dangerous "export crop mentality" typical of Nigerian agriculture as a whole, may be major obstacles in achieving that diversification of cropping which alone can ensure the agricultural stability of the Cocoa Belt. The competitive position of the Region's second major agricultural export, palm produce, is being similarly jeopardized by local opposition to the introduction of more effective methods of mechanized oil extraction. In the coming decade the whole policy of agricultural development based on an African peasantry, a policy on which successive British administrations have pinned their faith, will meet its greatest challenge. One type of answer to the challenge is provided by the formation of a policy of planned regional development for the basin of the Upper Ogun River in Oyo Province. It is in such an integration of a diversified agriculture with small-scale rural development based on hydro-electricity that the main hope for the maintenance of the Region's rural prosperity lies.

The low degree of development of factory industry has been described. There is, nevertheless, a wide range of secondary industries offering promising fields for local African enterprise, especially if electric power becomes more widely available: cassava processing, fruit-juice manufacture and canning, manufacture of boots and shoes, textiles, bricks, tiles and pottery. These small-scale industries possess marked social and economic advantages for they can be carried on in small units widely dispersed throughout the areas producing the raw-materials, and their requirements in the form of capital investment and labour skill are relatively modest. They, therefore, make it possible to obtain the maximum diffusion of the benefits of industry at a very small cost. In the past it was fashionable to ascribe the low degree of industrialization to the policy of the Imperial Power, but this criticism has been deprived of whatever scanty foundation of fact it may have possessed by the development policy of the Government during the last few years, and today it is becoming increasingly apparent that the major obstacles to industrialization are to be found in the attitudes of Nigerians themselves. Only too frequently the local businessman hesitates to invest in new industries, preferring the quicker returns to be obtained from trade; further, it is undoubtedly true that the number of individuals with the initiative, skill and tenacity which new industrial development demands, is small. Since the organizing ability and mechanical skills essential for modern industry cannot be acquired overnight the situation is likely to persist for some years to come. This does not imply any reflection on the innate ability of the Nigerian entrepreneur or worker, but it strongly suggests that for some time to come it will be difficult to dispense with European guidance and participation in the Region's economic development. Excellent examples of such collaboration are provided by the Pioneer Oil Mills scheme, by the Omu sawmills of Ijebu Province (a joint European and African enterprise under the auspices of the Colonial Development Corporation), and by the projected Ogun power scheme. These undertakings are of major importance in the economic development of the Region itself, and, on a wider scale, are of vital significance as offering an example of successful inter-racial co-operation in a continent increasingly torn by bitter racial animosities.

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# RACIAL GROUPINGS IN SINGAPORE

By B. W. HODDER

This paper is based mainly on data collected during a land-use survey directed by the Diagnostic Survey Team of the Singapore Improvement Trust. The work was carried out by thirty undergraduates from the Geography Department of the University of Malaya, who entered all properties in the congested centre of the city and interviewed the occupants. To Professor Dobby of the University of Malaya I am indebted for two reasons; he placed the amenities of the Department of Geography at my disposal, and consented to the students being employed on fieldwork; and he was always ready with helpful advice and encouragement. Mr. J. M. Fraser, Manager of the Singapore Improvement Trust, and Mr. D. H. Komlosy, Chief Planning Officer of the Diagnostic Survey Team, generously allowed me to publish some of this material, and I am particularly grateful to Mr. K. A. Watts, Research Officer of the Diagnostic Survey Team, for his help in collating data, preparing maps and for assisting me in numerous other ways.

THE RACIAL and Chinese tribal composition of the Singapore population is a most important aspect of the city's urban geography<sup>1</sup>. There are three main reasons for this. First, the population of the city is very mixed and is 45 per cent immigrant (Table 1). Second, more than half the city population is classed as illiterate in any language at all. Singapore, then, in spite of its wealth and strategic importance, is in many respects a socio-logically immature city where racial, tribal and economic divisions are still quite sharp. Third, these divisions often express themselves geographically, being grouped into particular parts of the city. The main purpose of this paper is to attempt a description and explanation of some of these groupings.

TABLE 1. RACIAL COMPOSITION OF THE POPULATION OF SINGAPORE CITY

Race	City Population <sup>2</sup>	Percentage of total population	Percentage born outside Singapore Colony <sup>3</sup>
Chinese ... ..	613,755	78.1	45
Malaysians ... ..	84,225	10.7	39
Indians ... ..	62,241	7.9	69
Europeans ... ..	10,419	1.3	90
Eurasians ... ..	9,304	1.2	11
Others ... ..	6,289	0.8	46
Total ... ..	786,233	100.0	45

1. *Race* here means "a judicious blend, for practical ends, of the ideas of geographic and ethnographic origin, political allegiance, and racial and social affinities and sympathies" —C. A. Vlieland, *A Report on the 1931 Census* (London, 1932), p. 75. Six main race- or community-groups have been distinguished in this paper, namely Chinese, Malaysian, Indian, European, Eurasian and 'Others'. Malaysians comprise both indigenous Malays, including aborigines, and immigrant Indonesians. Indian is used to cover natives of India, Pakistan and Ceylon, and their descendants. 'Others' as a group includes Nepalese and Burmese, as well as Arabs, Siamese and numerous other peoples. This classification differs from the 1947 Census classification in one respect only: the Census includes all Ceylonese under the heading 'Others'.

*Tribe* is here taken to be synonymous with what is often called a Chinese *Dialect Group*. The *Tribe*, in this sense, is really based upon "an inconsistent blend of political, geographic and linguistic, rather than ethnographic criteria". (C. A. Vlieland, op. cit., p. 77.)

These two definitions, vague though they may seem, have nevertheless won official approval for census purposes in Malaya; they do in fact express most accurately the local connotation of the words in this context.

2. Estimates for the end of 1952 from *Malayan Statistics* (Singapore, February 1953), p. 8.

3. Figures for 1947 from M. V. del Tufo, *A Report on the 1947 Census of Population* (London, 1949) Tables 42-43.

Since the landing of Sir Stamford Raffles in 1819, the population of Singapore has risen from some 150 fishermen and pirates, predominantly Malay<sup>1</sup>, to a mixed population of over 786,000 in the city<sup>2</sup>. Raffles was quick to appreciate the enormous potentialities of the Settlement's strategic position in South-East Asia and he began to plan his town with great energy and foresight; he gave particular attention to the

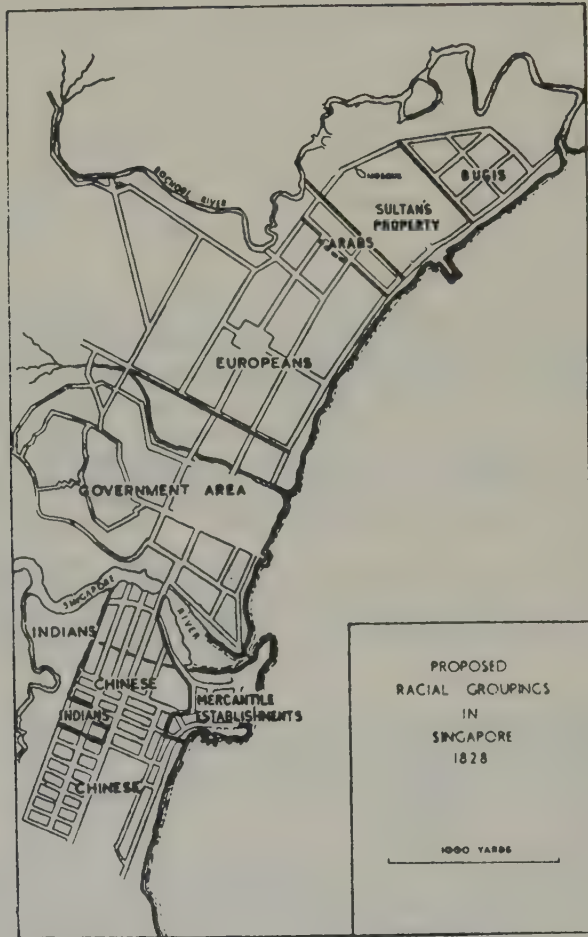


Fig. 1. Proposed Racial Groupings in Singapore, c. 1828. Redrawn from a plan by Lt. P. Jackson, showing the recommendations of the Town Committee (By courtesy of Raffles Museum, Singapore).

1. See W. Bartley, "Population of Singapore in 1819", *Journal of the Malayan Branch of the Royal Asiatic Society*. Vol. 11, pt. 2 (Singapore, 1933), p. 177.

There is a population of over 300,000 outside the city limits.

contemporary and probable future racial composition of the population. In 1822 he appointed a committee to appropriate and mark out "the quarters or departments of the several classes of the native population"<sup>1</sup>. Fig. 1 indicates the racial groupings as they were envisaged and as they did largely develop. The precise nature of this pattern was doubtless determined by several considerations. The European Town was placed on a fairly extensive and well-drained site adjacent to the Government area. The Arab and Bugis zones, on the other hand, were confined between the coast and the Rochore River, beyond which lay a swamp. Moreover, the Arabs and Bugis had strong religious affinities with the Moslem Malay Sultan, and the sea-trading Bugis could take advantage of the river mouth and coast at that point. In placing the Chinese, Raffles acted on his prediction—an accurate one—that "from the number of Chinese already settled, and the peculiar attractions of the place for that industrious race, it may be presumed that they will always form by far the largest portion of the community"<sup>2</sup>. A location next to the mercantile establishments was obviously suitable. The Indians, a vigorous class of merchants, were also in fairly close proximity to the mercantile zone and were given a river frontage of over a quarter of a mile. Thus, definite provision was made only for the immigrant population. Raffles expected the local Malays<sup>3</sup>, as a mainly fishing people, to settle either along the coasts and creeks beyond the town limits, or else well up the Singapore River<sup>4</sup>.

Certain significant changes in the geographical distribution of the various communities emerge from a study of maps and literature of the nineteenth century. A great many new *kampongs*<sup>5</sup> were noted, but they have in most cases survived only in name. By 1836 the Bugis had moved further north along the coast, while Kampong Java replaced the original Kampong Bugis. By the middle of the century Kampong Chulia (Indian) was replaced by Kampong Malacca (Malay), while Indians began to appear close to the mercantile establishments, where the present Chulia Street is located. John Cameron, writing in 1865, says of the many *kampongs*, "Though (they) . . . . were probably first occupied by the races whose name they bear, no such distinction appears now to exist"<sup>6</sup>. On the other hand H. Norman noted in 1895 that each race had its own quarters, and cited Kampongs Malacca, Kling, Siam and China<sup>7</sup>. The racial composition and distribution was becoming increasingly complex as the population of Singapore continued rapidly to increase.

Figs. 2 and 3 give some indication of changes in the numbers and racial composition of the population of Singapore Island. During the nineteenth century a rapid increase in the proportion of Chinese was accompanied by a decrease in the Malaysian proportion. Since 1900 the rate of increase of the total population has remained high, but until the last war migrational surplus accounted for most of the population growth; since then natural increase has become the most important factor. The natural increase of the Chinese is higher than that of any other community in Singapore so that the population of the island, and even more so of the city, is still becoming increasingly Chinese.

1. J. R. Logan, "Notices of Singapore", *Journal of the Indian Archipelago*, Vol. 8 (Singapore, 1854), p. 100.

2. J. R. Logan, *op. cit.*, p. 105.

3. Including the Orang Laut. See p. 25, footnote 1.

4. J. R. Logan, *op. cit.*, p. 108.

5. *Kampong* is the Malay word for village.

6. J. Cameron, *Our Tropical Possessions in Malayan India* (London, 1865), p. 69.

7. H. Norman, *The Peoples and Politics of the Far East* (London, 1895), p. 41.

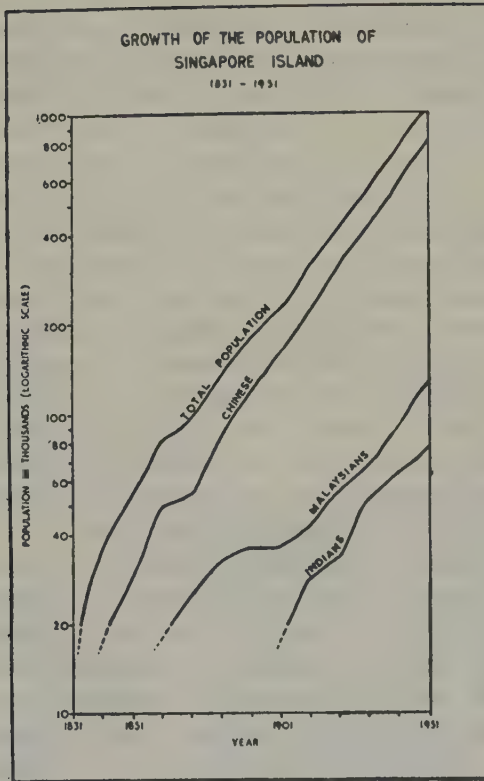


Fig. 2. Growth of the Population of Singapore Island, 1831-1951. Based on data from M. V. del Tufo, *A Report on the 1947 Census of Population*, p. 588, and *Malayan Statistics* (February, 1953), p. 8.

Fig. 3. Racial Composition of the Population of Singapore Island, 1824-1951. Based on data from M. V. del Tufo, *A Report on the 1947 Census of Population*, p. 588, and *Malayan Statistics* (February, 1953), p. 8.

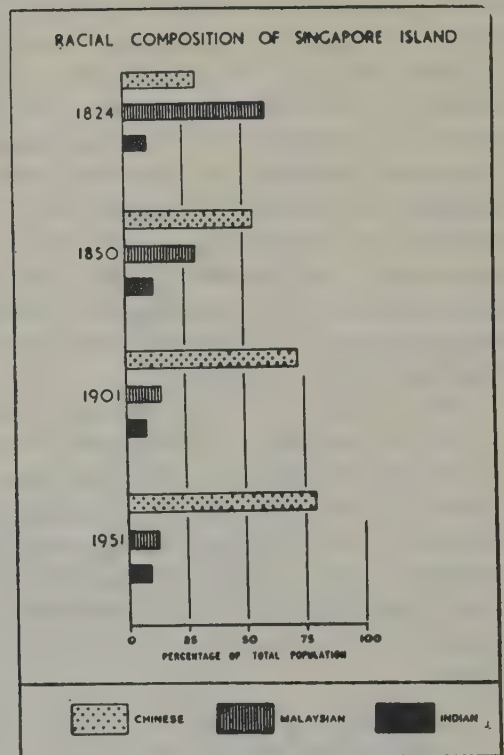


Fig. 4 indicates the relative importance of Chinese, Malaysians and Indians by administrative divisions in the city. While the Chinese achieve their greatest importance in the congested core, the Malaysians achieve theirs on the extreme western fringes, and the Indians are relatively most important immediately south of the central city area, where they work on the railway and docks'. It is unusual to find Europeans or Eurasians living in the congested core, but Europeans do fill the main hotels, and Eurasians are found in the apartment flats. The latter are more especially clerical workers in the adjacent government, cultural and business zones of the city. Apart from this central area, Europeans and Eurasians are widely separated in their main groupings. While the Eurasians concentrate in the extreme east near the coast, Europeans are grouped to the west and north-west, on hilly land near the University. Recently, however, Europeans have also shown a tendency to spread along the east coast.

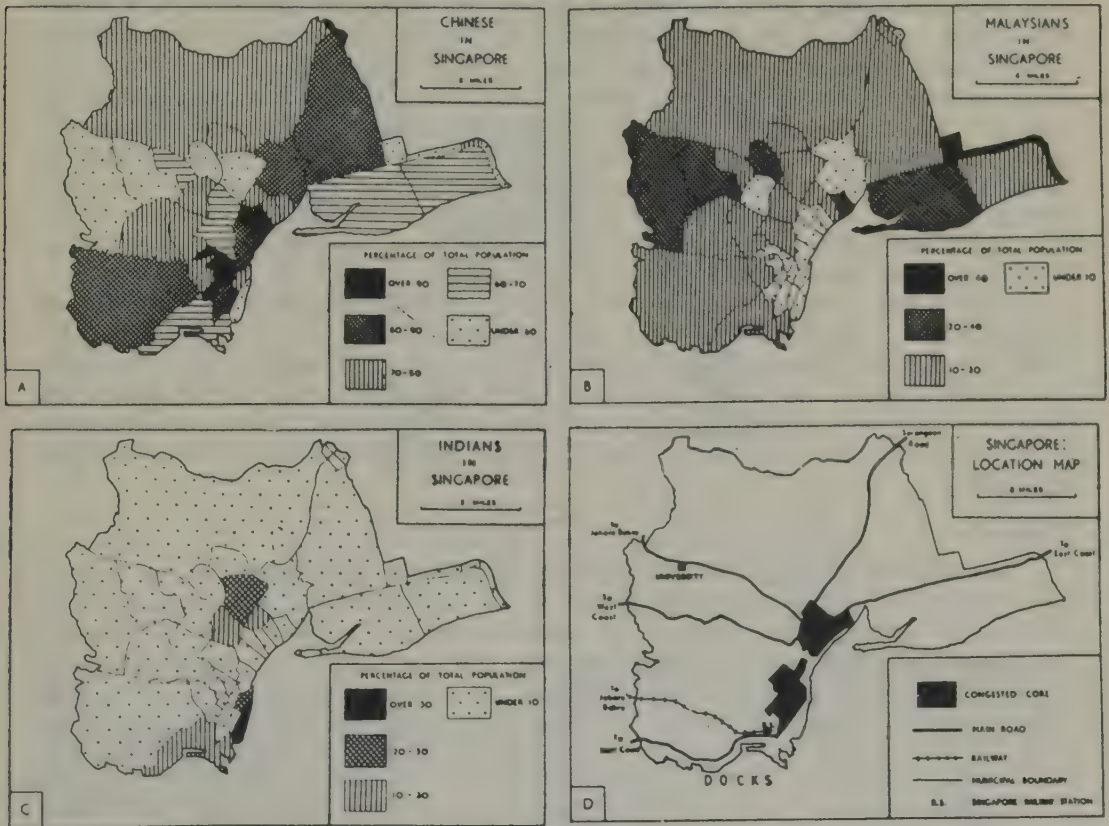


Fig. 4.

A. Chinese in Singapore City.

B. Malaysians in Singapore City.

C. Indians in Singapore City.

D. Location map of Singapore City.

Based on data from M. V. del Tufo, *A Report on the 1947 Census of Population*, Table 5.

These maps and comments summarize the available information about the racial groups outside the congested core. It is certain that the racial distribution inside the core is less fluid and more definite than it is outside where densities are very much lower, social levels more varied, and class, rather than racial, groupings tend to develop.

1. For the locations of places mentioned in the text see Fig. 4D.

## RACIAL GROUPINGS IN THE CENTRE OF SINGAPORE

The rest of this discussion is confined to the congested core of Singapore City<sup>1</sup>. This is divided into two distinct portions of roughly equal area south and north of Singapore River, which have been called "Old Town" and "New Town" respectively<sup>2</sup>.

*Problems of Mapping Racial Distributions*

The maps of present-day racial and tribal groupings (Figs. 5 and 7) are necessarily generalized reductions. In making the original more detailed maps, use was made of data collected during a house-to-house survey. The maps were constructed mainly on the basis of housing-block data. Thus, if one block of 30 houses returned 19 Chinese, 7 Indian, 2 Malaysian and 2 Eurasian houses, that block was mapped as Chinese—with two reservations. First, the block might return population figures of 55 Chinese, 50 Indians, 12 Malaysians and 4 Eurasians. A serious discrepancy between housing and population figures would then result. But in practice this objection generally proved to be unfounded. Not only do the Chinese have larger families on the average, but they tend also to take up less floor space per family than any other race in this congested core of the city. 50 per cent Chinese houses per block was quite sufficient to justify mapping that block as Chinese. Where, however, the housing figures were only slightly above 50 per cent Indian or Malaysian, it was necessary to examine closely the population figures to ensure that a block was not mapped, for instance, as Indian if its population was in fact over 50 per cent Chinese<sup>3</sup>.

The second problem resulting from basing the data for mapping purposes on housing blocks was found to be the fairly common discrepancy between block and street distribution. Thus, while by any criteria several adjacent blocks are overwhelmingly Chinese, the main road along which they lie may be solidly Indian on both sides. The most notable illustration of this is an Indian strip along the Serangoon Road. In all such cases it was necessary to show the distributions by streets as well as by blocks.

*Chinese*

The Chinese, forming about 80 per cent of the total city population, are ubiquitous; there are very few residential blocks in the congested core, which contain less than 10 per cent Chinese. However, the highest densities of Chinese and, incidentally, the highest population densities in Singapore, are located in an area roughly coincident with the original "Chinese Kampong" of the time of Raffles (Fig. 5). This "Chinatown" contains solid blocks of Chinese to the virtual exclusion of any other race. But even Raffles greatly underestimated the future growth of the population and the essentially Chinese character of the future city. It is possible to distinguish a second overwhelmingly Chinese area stretching inland from the coast north of the Government area. This concentration is in the northern portion of the original European Town, which became available as the Europeans moved out into the hilly suburbs. As early as 1865, Cameron referred to the area "where the European merchants originally had their residences, but which has now chiefly passed into the occupation of the natives"<sup>4</sup>. Thus while the first concentration of Chinese is but a perpetuation of the

1. While occupying only 5.5 per cent of the city area, this core contains 42 per cent of the total city population.

2. E. H. G. Dobby, "Singapore: Town and Country", *Geographical Review*, Vol. 30 (New York, 1940), p. 100.

3. It is clear, then, that the word *grouping* is used here to mean an area in which at least 50 per cent of the population is of one race or tribe. The number of races justifies the use of this low figure. On the other hand these racial and tribal groupings must not be thought of as being more definite and homogeneous than they really are.

4. J. Cameron, *op. cit.*, p. 69

original plan by Raffles, the second is an expression of the enormous actual and relative increase of the Chinese population in Singapore, coupled with the suburban movement of the Europeans.



Fig. 5. Racial Groupings in the Centre of Singapore, 1952. Based on unpublished data in the possession of *The Diagnostic Survey Team of the Singapore Improvement Trust*. For a definition of grouping see p. 30, footnote 3 above.

With their low average standard of living and indefatigability in the pursuit of wealth, the Chinese generally prefer the congested core. It is very significant that shop-houses are easily the most common type of building in the two Chinatowns. Population densities here frequently exceed 100 persons per house. Fig. 6 shows the distribution of these shop-houses.

### Malaysians

Malaysians show their greatest densities and most homogeneous groupings at the extreme eastern limits of the city, on poorly-drained squatter and *kampong* land fringing tidal swamps (Fig. 5). Only two small Malaysian groupings may be distinguished within the congested core. Reference has already been made to the emergence during the nineteenth century of Kampongs Java and Boyan in roughly the same area as the earlier Kampong Bugis, i.e. adjacent to the Malay Sultan's property. Though this latter is now largely built over, the large mosque is still a powerful focus for Malaysians. The main Malaysian grouping today is located where these Indonesian kampongs previously existed,



Fig. 6. Shop and Residential Areas in the Centre of Singapore. Based on unpublished data in the possession of *The Diagnostic Survey Team* of the *Singapore Improvement Trust*.

and street names are still distinctly Indonesian, e.g. Sumbawa, Palembang, and Java Streets. Moreover, Indonesians predominate in this grouping of Malaysians, while Malays predominate among the Malaysians concentrated on the eastern fringe of the city area.

Whereas historical and cultural influences have largely determined the location of the first Malaysian grouping within the congested core, the second grouping has a simple occupational explanation. Malaysians are prominent as Post Office workers and policemen in Singapore, and this second grouping, to the south of Singapore River beyond Chinatown, is closely related to the existence there of Post Office and Police quarters.

### *Indians*

Four Indian groupings may be distinguished, in all of which Tamils predominate<sup>1</sup>. The earliest one lies along the western fringe of the business zone and was indicated at least as early as 1836 by the presence there of Kling Street (now Chulia Street). In this area the Indians are petty shopkeepers, or else form the distinctive watchman and doorman class for the banks, offices and stores of the commercial area; there are also Indian small bankers and lawyers. A second grouping may be distinguished just north of Singapore River, in the High Street district, and a third in the Arab Street area further north, off Beach Road; in both these groupings there are numerous small traders dealing in jewellery and textiles. The fourth grouping of Indians is the shopkeeping element along the Serangoon Road, one of the main lines along which settlement radiated during the late nineteenth century. Unable to find room to establish a fairly homogeneous community within the town, the Indians began a ribbon development along the Serangoon Road, later to be backed by Chinese overflowing from the town centre. Government coolie lines have intensified and confirmed this fourth Indian grouping, for most of the Public Works labourers in the city are Indians and they are numerous in many other departments of Public Administration. All four Indian groupings include many shop-houses, which reflect the small business and trading character of the community. This is in contrast to the Malaysian groupings, where shop houses are uncommon (Fig. 6).

The main general conclusion to be drawn from the distributions discussed above is that the racial groupings in the congested core are to some extent explicable in terms not only of a perpetuation of historical facts, but also of present-day tendencies towards occupational specialization by races.

### CHINESE TRIBAL GROUPINGS

Each of the tribes has a distinctive dialect, but the word *dialect* is misleading in this context. It has been suggested that the Chinese dialects are as distinct from one another as the languages of Europe; language, in fact, is for practical purposes a more useful designation. The dialects of Chinese tribes are generally mutually unintelligible and they are very numerous. Five tribes, however, predominate, of which three account for 82 per cent of the total Chinese population in the city<sup>2</sup>. In this respect the Chinese are less homogeneous than the Indians<sup>3</sup>, but their tribes do show far more homogeneous geographical groupings than do the Indian communities. It is significant that Raffles speedily appreciated the need to recognize the existence of the Chinese tribal groups, and urged his Committee of 1822 "to advert to the provincial and other distinctions among this peculiar people"<sup>4</sup>.

1. The Indian community groups are Tamil, 62.6 per cent; Malayali, 10.1 per cent; Punjabi, 5.5 per cent; Sikh, 3.3 per cent; Others, 18.5 per cent (Census Report for 1947, pp. 296-9).

2. For a definition of *tribe* as used in this context see p. 25, footnote 1.

3. See footnote 1 above.

4. J. R. Logan, *op. cit.*, p. 105.

TABLE 2. TRIBAL COMPOSITION OF SINGAPORE CHINESE

Tribe						Percentage of Total Chinese in Singapore City <sup>1</sup>	
Hokkien	...	...	...	...	...	35.9	} 82
Cantonese	...	...	...	...	...	26.8	
Tiechiu	...	...	...	...	...	19.3	
Hainanese (Hailam)	...	...	...	...	...	6.9	
Hakka (Kheh)	...	...	...	...	...	5.9	
Hokchiu	...	...	...	...	...	1.6	
Hokchia	...	...	...	...	...	1.1	
Others	...	...	...	...	...	2.9	
						100.0	

South of Singapore River the tribal pattern today is quite simple: the three main Chinese tribes show quite definite groupings into separate areas (Fig. 7). There is a clear distinction between the Hokkien and Cantonese areas of Chinatown. The location of the Hokkien in the older portions of Chinatown, in a zone close to the river and coast, and near the business area, reflects the dominance of Hokkien in the early Singapore immigrants and the fact that most of the merchants were of this tribe. They are still the most numerous tribe (see Table 2) and dominate in the mercantile activities, in the export trade and in big business. Further, the Cantonese were predominantly artisans of all kinds, and thus had no great need of a location suitable for commercial activities.

The Tiechiu area, mainly on the right bank of the Singapore River, is very compact. The explanation of this particular location lies in their occupation. The Tiechiu here are engaged in the transfer of goods between the warehouses along the river-side and the numerous *tongkangs*<sup>2</sup> which crowd the river itself. The Tiechiu also dominate in some sections of the inter-island boat-trade, dealing more especially with West Borneo and Siam where there are substantial Tiechiu trading communities.

These three main tribal groupings south of Singapore River are comparatively homogeneous; all contain many blocks of which the population is solidly Chinese and over 90 per cent of one tribe. North of the river, however, the Chinese tribal pattern is more complicated. Hokkien, Cantonese and Tiechiu are there in large numbers, but while there is one large Hokkien grouping, all three of the main tribes show smaller scattered groupings, and rather less homogeneity. Stretching inland from Beach Road, just north of the Government area, there is a distinct grouping of Hainanese (Hailam)<sup>3</sup>. Local Chinese refer to certain streets in the neighbourhood as Hailam One Street, Hailam Two Street and so on. To explain this location of the Hainanese is not easy, but occupational specialization is certainly an important factor. The Hainanese are noted as waiters, cooks and domestic servants, and this grouping is very close to several of the more important hotels, while many of the Hainanese act as waiters on board ships. The dock area south of the city is of course quite distant, but the social attraction of living where Hainanese have already formed a fairly homogeneous community appears to be strong enough to outweigh the disadvantages of distance.

1. Data from the Census Report for 1947, pp. 294-5.

2. Small boats

3. It was observed that Hainanese often professed to belong to a different tribe, especially Hokkien, once they had become reasonably successful in business.

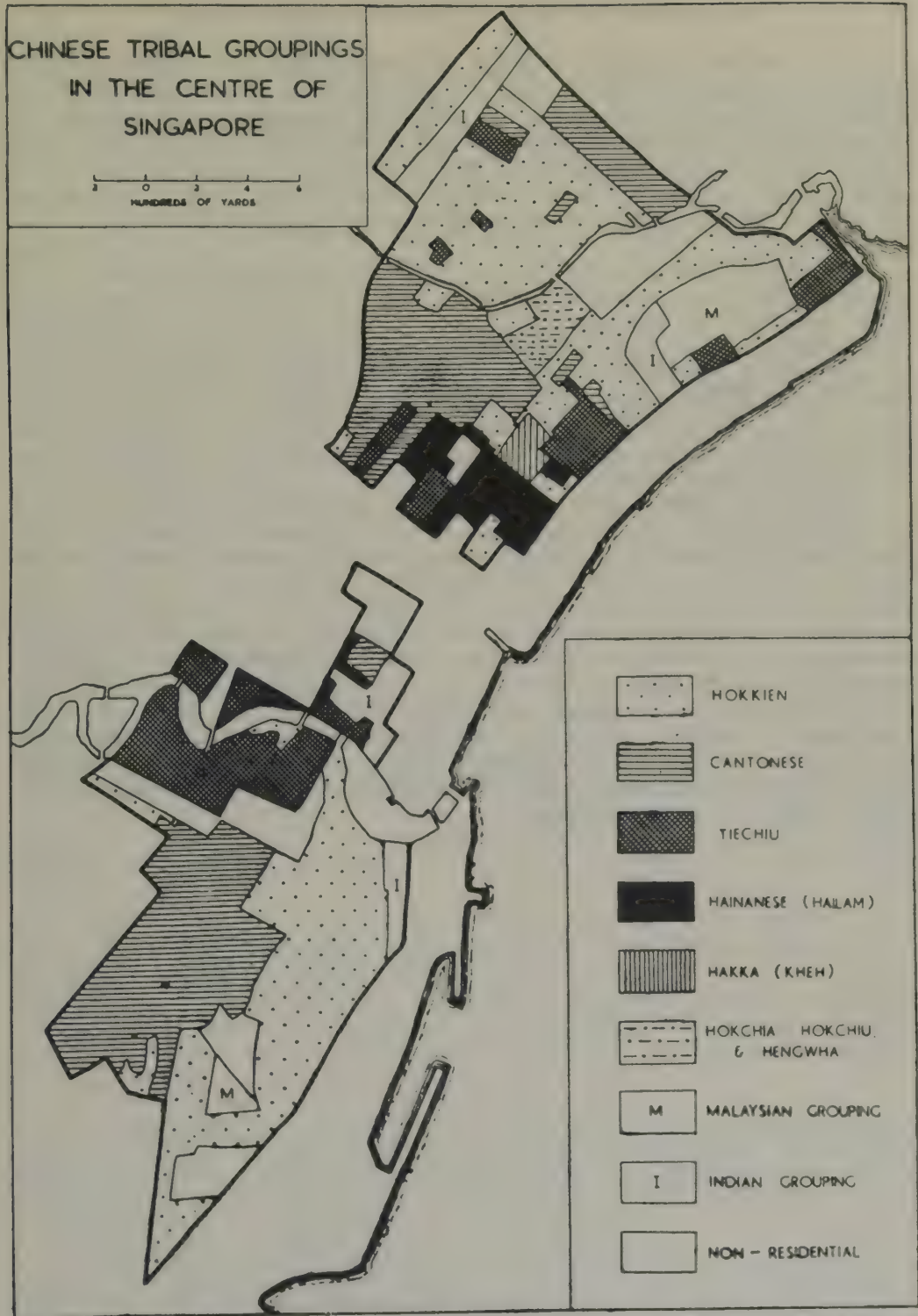


Fig. 7. Chinese Tribal Groupings in the Centre of Singapore. Based on unpublished data in the possession of *The Diagnostic Survey Team of the Singapore Improvement Trust*.

While distinct groupings of Hokkien, Cantonese, Tiechiu and Hainanese can be found, there is only one small grouping of Hakka (Kheh) in the congested core. These people do not come from any specific area in China; they normally speak a second dialect and show no significant occupational specialization. In the centre of this northern area is a small grouping of Hokchia and Hokchiu. Here are the main omnibus termini, and the Chinese of these two tribes dominate as drivers and conductors; they are also prominent in the numerous bicycle-repair shops in the area and are the main trishaw-riders in the city.

It is generally true of a Chinese in Singapore that he will gravitate towards those of his own tribe. Remembering the high rate of illiteracy and the mutual unintelligibility of the dialects it is not surprising that a Cantonese, for example, finds many difficulties in a strictly Hokkien area. Although dialect is probably the most important single factor in perpetuating the separation, there are numerous other problems. Thus the cooked foods sold and eaten in adjacent groupings may be quite different, a fact of real importance in areas where pressure of population demands outside communal rather than internal domestic cooking. Again, the Chinese tend to perpetuate in Singapore local family ties and village communities from China.

Singapore is unique in the extent of its racial and Chinese tribal groupings. It is perhaps inevitable that so far very little mixing of the races should have taken place. The growth of the population has always been very rapid and, until the last few years, almost wholly due to the mass immigration of Chinese and to a lesser extent Indians and Malaysians. Further, many of these immigrants had no intention of settling permanently in Singapore; they were interested only in amassing enough wealth to return to their own country. There was little time, incentive or opportunity for assimilation. In spite of the increasingly permanent nature of the Singapore population, the high rate of illiteracy and often mutual unintelligibility are keeping the races and Chinese tribal groups to some extent socially, occupationally and geographically distinct. The general tendency is undoubtedly towards a weakening of racial and tribal occupational specialization, but this is unlikely to express itself geographically in the congested core while enormously high densities persist.

# THE ECONOMIC GEOGRAPHY OF A ONE-ACRE FARM ON SINGAPORE ISLAND

## *A Study in Applied Micro-Geography*

By J. M. BLAUT

This paper is based on field work carried out with the aid of four students from the Geography Department of the University of Malaya: Wong Lee Hoon, Hamzah Sendut, Mohammad Anas, and Tan Chok Kian. Professor Dobby of the University of Malaya allowed me to use the Department of Geography as my headquarters, and consented to the students working with me in the field. I also gratefully acknowledge the help I have received from Professors E. A. Ackerman, A. H. Clark, J. N. E. Efferson, F. Hardy and F. J. Kniffen, and from members of the Departments of Geography and Economics of the University of Malaya. I am particularly indebted to the officers of the Singapore Government, notably of the Agricultural, Commerce and Industry, Survey, and Veterinary Departments, who provided financial assistance, statistics and aerial photographs. But the greatest measure of thanks must be reserved for Mr. Ng Hong and his family for their friendly and helpful co-operation.

THE MICRO-GEOGRAPHIC approach has proved capable of providing data of an order of intensity and exactitude often lacking in macro-regional studies<sup>1</sup>. It is particularly applicable to situations in which the geographer cannot obtain adequate background data on the economic, cultural or environmental characteristics of a region. Under such circumstances, if he is to avoid superficiality, he may have to reduce the scope of the problem, the area investigated, or both. Sometimes, however, both the over-all size of the region and the scope of the problem must be treated as given: this is especially true of many studies associated with regional development efforts. In such instances, attempts to increase exactitude and detail by reducing the area actually studied in the field, and by dealing with segments of the region in correspondingly greater detail, may prove useful.

Numerous examples of large-scale studies are available. Most, however, appear to fall into one of two categories: either the range of data collected is limited, or the study, while comprehensive, deals with unrepresentative segments of the larger region. In a few instances micro-studies have been placed in their macro-regional setting, either through a comparison of the data obtained for micro-regions with available information on the macro-region<sup>2</sup>, or through selection of a reasonably typical segment<sup>3</sup>, or through a system of multiple micro-studies, representative or otherwise<sup>4</sup>.

1. R. S. Platt has dealt fully with micro-geographic theory in numerous writings. See, for example, his (1) "Items in the Regional Geography of Panama: With Some Comments on Some Comments on Contemporary Geographic Method", *Annals of the Association of American Geographers*, vol. 28 (Lancaster, Pennsylvania, 1938), pp. 13-36; (2) "Reconnaissance in British Guiana, With Comments on Micro-geography", *op. cit.*, vol. 29 (1939), pp. 105-26; (3) *Latin America: Country-Sides and United Regions* (New York, 1942). See also Richard Hartshorne, "The Nature of Geography", *Annals. Assn. Amer. Geog.*, vol. 29, Nos. 3 and 4, 1939 especially pp. 452-5; and Preston E. James, "Toward a Further Understanding of the Regional Concept", *Annals. Assn. Amer. Geog.*, vol. 42 (1952), pp. 196-222.

2. R. S. Platt, "Items in the Regional Geography of Panama" and *Latin America*.

3. See Steel's discussion of the Agogo project in: M. Fortes, R. W. Steel and P. Ady, "Ashanti Survey, 1945-6: An experiment in Social Research", *Geographical Journal*, vol. 110 (London, 1948), pp. 147-79. Steel's comment on the representativeness of the area is significant. "First and subsequent impressions made us feel justified in regarding Agogo as fairly typical of the larger centres of the cocoa areas in Ashanti" (p. 156).

4. An example of careful micro-regional sampling is provided by F. Gregor; "A Sample Study of the California Ranch", *Annals. Assn. Amer. Geog.*, vol. 41 (1951), pp. 285-306.

The present paper is concerned with an effort to apply the micro-geographic approach to an investigation of Singapore small-holder agriculture<sup>1</sup>. As the investigation aimed to provide data for a partial basis for agricultural planning in an area of highly complex Chinese mixed and leafy-vegetable farming<sup>2</sup>, about which little was known, it was felt that the primary unit for study should be the individual farm. Accordingly, about 400 farms, roughly 10 per cent of the total number on Singapore Island, were investigated on a micro-geographic level of intensity. The aim of the present paper is to illustrate the methods employed, the types of data obtained, and the nature of the conclusions drawn, by means of a detailed description of one farm.

### THE NG FARM<sup>3</sup>

Perhaps the most interesting farming region on Singapore Island is the lower Kallang plain, a compact area of about 225 small-holdings, nearly all specialized producers of leafy-vegetables for sale in Singapore markets<sup>4</sup>. The Kallang plain is one of many irregular flood-plains fingering into the heart of Singapore Island, and the Kallang farming region covers a quarter of a square mile of its lowest constricted portion, at a point where recent urban expansion has occupied the uplands on both sides of the plain, leaving the farming region as a narrow rural peninsula. To the eye the farming region appears as a highly condensed, agricultural landscape (Fig. 1). Houses and small irregular ponds dot the area, and, except for small farmyards, narrow drains and clumps of trees, the land surface is almost completely covered by blocks of elongated vegetable beds and bordering paths. The Ng farm lies near the edge of the plain, bordering the Kallang River.

Heavy, non-humic, infertile clay soils, saturated almost to the surface, underlie the portion of the region which includes the Ng Farm<sup>5</sup>; lighter soils, especially sandy clays, underlie the remainder. Rainfall in the plain is high, roughly 98 inches annually. Although long-term records reveal only slight seasonality, short-term fluctuations are frequent, severe and unpredictable. Thus, in any month violent or prolonged rains may cause serious damage, or droughts may cause some ponds to dry out. Temperatures, however, vary little from a daily mean of 80° F. and a daily range of 12° F<sup>6</sup>.

1. The term *small-holder agriculture* is used here in preference to the more common *peasant agriculture*. Its meaning is considered to be equivalent to *family-sized farming*.

2. Mixed farms, raising pigs, chickens and some crops for sale and manure, and other crops for stock-feed, in a partially closed nutrient cycle, represent one of the two major types of farming on Singapore Island. Leafy-vegetable farming represents the other.

3. This farm is one of twelve in the area which were selected for detailed study, involving periodic re-visits. It was chosen for presentation here on the basis of the following criteria: the farm had to be one of these twelve so that yield data would be as accurate as possible (yield records were kept for the selected farms over a period of up to six months); among the twelve, it had to be one of the eight "pure" farms having no significant outside source of income; and Ng Hong was judged to be the most co-operative and reliable of these eight farmers.

As the farmer keeps no records, the means available for studying the farm were direct observation (including measurement), interviewing, and available information on climate and prices. Interview data were checked as carefully as possible by comparison with observations and by internal checks on consistency, but they must be assumed to be subject to the inaccuracies and errors associated with this technique, especially since cultural distance and the necessity for employing an interpreter posed special obstacles.

4. The interest attaching to this region derives from certain of its characteristics, which indicate it to be an unusually intensive and commercialized example of tropical small-holder agriculture. Farms average 6/10 of an acre in total area; yields amount roughly to 10 tons per farm; farm dwelling population in the 90-acre core of the area is equivalent to a density of 7,040 per square mile. Production is highly specialized: few farms in the core-area grow significant amounts of any type of produce other than leafy-vegetables, and nearly all of the production is sold in city markets.

5. The soil appears to be a gley, with partially decomposed organic matter well below the zone of cultivation. Long cultivation has destroyed visible horizons and has intruded particles of foreign matter, such as charcoal and baked clay, to depths of at least 24 in. below path-level.

6. Climatic data are from the *Annual Summary of Observations*, Malayan Meteorological Service, Singapore, and other records supplied by the same agency. The annual rainfall value is an interpolation of averages from two stations located in opposite directions from the plain, and each about three miles away. The averages are: Kallang Aerodrome (1935-41, 1948-52), 92.99 in., MacRitchie Reservoir (1931-9, 1952-3), 102.11 in. Lack of contemporaneity, shortness of the period, and discrepancy between records for the two stations for any one month or year, indicate that the annual figure given for the Kallang plain (97.55 in.) is only a rough approximation. This is borne out by the 1952 figure for a sub-station located a quarter of a mile from the Ng farm, which recorded 123 in. as against the average for the two other stations of 116 in.

# ECONOMIC GEOGRAPHY OF A ONE-ACRE FARM



Fig. 1.

A. Aerial photograph of part of the Kallang plain. The white line encloses the Ng Farm.

B. Land-utilization map of the same area. The number of vegetable beds in each block is only approximately correct. Much of the land shown as *wasteland and farmyards* is either too swampy for cultivation or lies in the shadow of fruit trees in farmyards. Note the partially-integrated network of ponds and drains, mostly adjoining blocks of vegetable beds.

## Spatial Patterns

The total area of the Ng farm is one acre. Vegetable beds occupy 13,956 sq. ft.<sup>1</sup> The beds are rectangular, averaging about 40 ft. in length, and with a width of about 3 ft. Their surfaces are cambered, rising perhaps 6 to 9 in. above the bordering paths,

<sup>1</sup> For purposes of comparison with cultivated-acreage statistics elsewhere, the bed-area should be multiplied by 1.33 to include the area of inter-bed paths.

and are cut at the edges. The farm-house is built on a thin cement foundation, and has walls of vertical wooden boards, and an attap roof. The adjoining shed is roofed with corrugated iron. Four small ponds border the vegetable beds on two opposite sides. The remaining area consists of shallow drains, paths between beds, the main path leading from the farm, and small open spaces in most of which containers of liquid fertilizers are kept. Little, if any, of the land may be classed as waste, and none of the beds lie fallow for more than a day or so at a time.

Seven types of crops and one type of stock are produced on the farm. One of the crops, sugar cane, is insignificant in area, and is used only for home consumption. The poultry are also used only for home consumption. Of the remaining six crops, one, *choy sam* (*Brassica chinensis*, "Chinese spinach"), strongly predominates, accounting for 80 per cent of the total cultivated area<sup>1</sup>. In descending order of importance, *sai yung choy* (*Nasturtium aquaticum*, "Chinese cress") occupies 9 per cent of the total cultivated area; *choong* (*Apium cepa*, "spring onion") occupies 6½ per cent; *pak choy* (another variety of *Brassica chinensis*) occupies 3 per cent; and *kan choy* (*Apium graveolens*, "Chinese celery") occupies 1½ per cent. *Kang kong* (*Ipomæa reptans*) is grown haphazardly in one of the ponds.

### *The Farm Family*

The farm dwelling population consists of nine members of a single family, including the farmer himself, his mother, his wife, and his six children. The farmer, his wife, his still vigorous mother, and the eldest daughter, a girl of perhaps eighteen, form the effective labour force. None of them appears to be employed elsewhere at any time during the year, and no outside labour is employed on the farm.

The farmer was born and grew up in a village in the Si-Pei plain of Kwangtung, and has apparently been farming all his life. The farms of his village produced rice, mulberry, and, in addition to some other crops, leafy-vegetables, which included many of the varieties found on the present farm. Crop cycles, methods of growing, and other aspects of vegetable production were similar enough to those practised on the present farm to suggest that the farmer learnt at least some of the basic operations associated with this type of farming before he came to Malaya. The rest he learnt from his neighbours in the Kallang plain or devised himself. It should be noted that, in contrast to Kallang farming, leafy-vegetable production in the village in China was not commercialized, although a small surplus was sold on occasion in a near-by market town.

Ng Hong settled on his present farm about 1929, growing leafy-vegetables apparently from the start, and apart from minor changes in types and acreages of crops, it appears that he has maintained about the same type of farming since his arrival. For ten years prior to that time he believes the land to have been under leafy-vegetable cultivation; still earlier, he believes it to have been under pineapple.

### *Farming Operations and Methods*

Operations and methods associated with the production of *choy sam* are similar to those used for all other crops except *kang kong* and cane; whatever differences exist are rendered insignificant in the total picture by the predominant importance of *choy sam*. It will, therefore, be sufficient for us to limit our discussion largely to this crop.

*Choy sam* is grown in two stages, each lasting about three weeks. Seeds, after having been treated with kerosene to minimize pest damage, are densely planted in nursery beds, in close rows running transverse to the length of the bed. About twenty

1. The names of vegetables given here are transliterations of the Cantonese names. For descriptions of these and other vegetables, see: J. N. Milsum and D. H. Grist, *Vegetable Gardening in Malaya* (Kuala Lumpur, 1941), pp. 61-139; and D. H. Grist, *An Outline of Malayan Agriculture* (London, 1936), pp. 247-58.

days later transplanting begins: usually about seven beds (henceforth referred to as *field beds*) are supplied by one nursery bed, the latter retaining enough seedlings for a normal harvest. Transplanting is spread over a period of several days: as successive plants reach an adequate growth stage they are transferred, filling successively more field beds. An average of about 41 days elapses between the seeding and harvesting of this crop<sup>1</sup>.

Beds are harvested in the evening to minimize wilting before the next morning's trip to market. Following harvest, the beds lie fallow overnight; the next morning the initial operations involved in preparing them for the succeeding crop take place. First, lime powder is cast over the beds. Next, the soil is turned over and deep-cultivated with a hoe, limed again, and re-worked into a fine tilth. The beds are then shaped, "burnt earth"<sup>2</sup> is added, and, late in the afternoon, "prawn dust"<sup>3</sup> is applied at a rate of 5 to 7 lb. to the average nursery and field-bed alike. The beds are next watered, seeds are planted in, or seedlings transplanted to them, and the beds are watered a second time. Palm fronds are laid over each bed for the first few days, to protect the plants against the direct effects of the high sun and heavy showers.

The major operations carried out during the growing period include watering, fertilizing and weeding. Watering is undertaken regularly: each bed is watered at least once a day, except when rain continues throughout the day, or when early rains are followed by uninterrupted heavy cloud cover. Normally two or three waterings take place; on sunny days during dry spells there may be as many as four. Both nursery and field beds are fertilized again during this period, ten days after seeding for the former and a week after transplanting for the latter. The average application in both cases is about 10 lb. to a bed. Weeding does not appear to be undertaken as a separate operation except, at times, by the younger children. Weeds have little chance of survival since they are pulled individually when discovered.

All *choy sam* plants in the same bed are normally harvested at the same time, regardless of degree of development. Although the usual crop cycle is 40–43 days, harvesting may take place earlier if prices (which fluctuate violently from day to day) suddenly rise shortly before the normal harvest date, or later if they have as suddenly declined. In the former case the weight, and in the latter case the quality of the vegetables, may be lowered, but total returns will be greater. All plants harvested in the evening are washed, left wet in baskets, and shortly after 3 a.m., taken by lorry to the farmers' market in the city, where bargaining between wholesalers and one of the farm women takes place<sup>4</sup>.

### *Form and Function of the Major Productive Items of Material Culture*

Three types of field equipment, the storage and chicken shed, and several varieties of watertight containers and woven baskets are the most significant permanent items of material culture which function in the resource-utilization and production process. The three types of field equipment are: the hoe, a dual-bucket watering apparatus, and a light hand-pump for squirting water. The watering apparatus has two open-topped

1. The cycles for other crops are as follows: *sai yung choy*, 1½ months; *choong*, 20 days; *pak choy*, 43 days; *kan choy*, 4 months.

2. *Burnt Earth* is a name used locally for crumbled, baked clay, mixed with small quantities of charred organic matter. It is obtained as follows: after harvest of a bed, the soil that has washed down to the paths is piled in a heap to which weed gleanings and additional soil are continually added. The mixture is kept permanently smouldering. When a portion has baked sufficiently it is put back into the bed, some being added at each bed-preparation. The function of the baked clay may relate to water-retaining properties and ease of cultivation; the charred organic matter provides a relatively insignificant increment of fertility.

3. See p. 45.

4. Even when prices are unexpectedly high it is impossible for the farm to market a second batch of vegetables. To do so would require an early-morning harvest and a second trip to market. Since wholesalers, anticipating the day's demand, establish an early price which declines as the market reaches surfeit, by the time a second load were brought prices would have dropped below production costs, or below the price anticipated for the following morning.

wooden or metal buckets suspended from either end of a shoulder-piece, each bucket having a spout and spreader. The bar can be conveniently sprung across the shoulders, allowing easy lifting and movement of the buckets. The farmer steps down into a pond with the implement, leans forward to fill the buckets, then carries the water back to the beds, and spreads from both buckets simultaneously. The hand-pump is a thin tube with an inner rod and suction cap for drawing and squirting water; it gives a fine spray which cannot damage seedlings or tilth, or wash away seeds, fertilizer or soil. Its use is limited to seed-beds and newly transplanted field-beds, where exceptional gentleness is required and leaves are not large enough to intercept the spray. It would seem that the field equipment used on the Ng farm is about as efficient as this type of farming, in this setting, will allow. The farmer appears to be acquainted with the main varieties of hand-tools sold in Singapore, including a representative selection of the varieties produced in Europe, and has selected those he prefers. Mechanization of field equipment would not appear feasible on this farm, in view of its size and the extreme care which needs to be taken in field operations in order to maintain production at economic levels.

The shed serves as a rain-proof store for bags of prawn dust, lime, etc., and as a chicken coop, from which chickens are never let out as a precaution against scratching of the vegetable beds. The watertight containers include metal pails, and large earthenware pots holding decomposing prawn dust<sup>1</sup>.

### *Productive Activities*

Harvesting, marketing, preparation and planting of beds, watering and fertilizing are the sequences of productive activities on the Ng farm which involve the most significant outlay of time and effort. Although their functions are described elsewhere, it seems desirable here to analyse each in terms of the length of time taken, the effort involved, and the place each operation has in the daily cycle of activities<sup>2</sup>. With 119 beds of vegetables of all sorts on the farm, a mean crop cycle<sup>3</sup> of about 42 days, and a semi-cycle created by transplanting, any sequence carried out once during a single cycle for a single bed must be repeated for the farm as a whole roughly four or five times a day.

The working day begins at dawn, although one of the farm women markets the vegetables as early as 3 a.m. The farmer begins work about seven<sup>4</sup>, his first job usually being the preparation of beds harvested the previous evening. The farm women at the same time are washing clothes, getting the children ready for school, and cooking. As soon as the first bed has been prepared the farmer must, if the day is sunny and no rain has fallen during the night, carry out the first watering; this takes him about two hours, and involves some forty trips to the ponds and back. Use of the buckets is an extremely arduous task which the farmer himself normally undertakes, although he is assisted at times by the adult women. By about 10 a.m., when the first watering is finished, the farmer's wife and eldest daughter have completed their household tasks and are ready to join him in the field; his mother, however, is occupied in cooking

1. Normally 100-150 lb. of prawn dust is kept immersed in water at all times, and allowed to decompose for at least a week. When decomposed it acts much more rapidly on the vegetables than it does when applied dry: visible results appear after one or two, instead of five, days. Thus, when prices rise, the decomposed prawn dust is applied to near-mature beds to hasten maturation and take advantage of the high price. During a run of high prices large quantities are decomposed in this fashion; at such times a small amount of "shark's fin" is also purchased, as it also acts rapidly. The use of human or pig manure is forbidden within the city limits.

2. The daily cycle here is the equatorial counterpart of the temperate farmer's annual cycle of activities. The contrast is striking on farms such as the present one, where a certain degree of success is achieved in modulating even the relatively slight seasonality of rainfall. (Compare, for example, W. R. Mead's discussion of the annual cycle on Finnish farms: "The Farmer's Year: A Geographical Record of Seasonal Activities", in the Indian Geographical Society's *Silver Jubilee Souvenir and N. Subrahmanyam Memorial Volume* (Madras, 1952), pp. 97-100.

3. i.e., a weighted average for all crops of the crop cycle multiplied by the proportional area of each.

4. This is no more than a few minutes after effective daybreak.

from the time she returns to the farm until the noon meal is served. Between 10 a.m. and 12 the farmer, assisted by one of the women, is usually occupied in preparing beds. With two working, one bed can be prepared in a half-hour. The second woman may simultaneously be watering the seed-beds and newly-transplanted field-beds with the light hand-pump. Often, however, the farmer must begin a second watering almost immediately after the first is completed; at such times bed-preparation must be carried out by the women alone during this period.

At noon, or shortly after, the main meal is eaten. Following this, the four adults work in the fields, continuing thus until after nightfall. On most afternoons the farmer must carry out at least one more watering; in the afternoons also fertilizers are applied by the farmer himself if he can spare the time from watering. The three women are simultaneously seeding or transplanting in the beds that have been prepared. Harvesting usually begins between 4 and 5 p.m., and lasts until 7 or 8. The whole family, excluding perhaps the younger children, participates in this operation, although the farmer himself may be occupied in watering or fertilizing for at least part of the time.

The farmer spends twelve to thirteen hours in the field in a normal day<sup>1</sup>, i.e., one in which little or no rain falls during the daylight hours, cloud cover is slight, and no rain has fallen during the preceding night<sup>2</sup>. If, however, the soil is thoroughly wet at dawn, or various combinations of cloud and rain occur during the day, the number of waterings may be only two, one, or occasionally none. If only one watering takes place, the farmer may have some leisure; if more, he will have little or none. When three waterings are carried out, as is normally the case, the farmer spends some six hours at this task; two to three more are spent in preparing beds, and the remainder are devoted to fertilizing, harvesting, and carrying out various irregular tasks such as deepening ponds, repairing, attending to the preparation of burnt earth or decomposed prawn dust, etc. The adult women put in a total of about twenty-eight hours in productive activities, in the field and at market; this is estimated to be equivalent to the work of one and a half adult males working a twelve-hour day<sup>3</sup>.

### *Resource-Utilization and Production*

From a geographical standpoint, perhaps the most striking characteristic of the Ng farm is the degree to which the family's efforts have modified the effects on the vegetables of natural ecological conditions. Few factors in the physical environment are, in fact, allowed to operate directly (day-length may be the only significant exception); productivity and the use of materials encourage favourable conditions and ameliorate or eliminate unfavourable ones.

Of the ecological conditions necessary to the growth of leafy-vegetables, soil aeration appears to be the only one so nearly lacking in the "natural" or "original" Ng farm environment as to suggest that, without human intervention, leafy-vegetables would be unable to grow there. However, soil fertility would be too low, rainfall inadequate, sunlight often too intense, and harmful organisms too numerous, to allow anything but a minimal and irregular yield of this kind of crop if soil aeration were the only factor maintained at an optimum level.

1. A comparison may be ventured here with the dawn-to-dusk working day of the temperate-zone farmer which, though it varies in length with the seasons, probably comes to roughly the same number of hours per year in productive activities. (See W. R. Mead, *op. cit.*).

2. In 1952, 218 24-hour periods had no rain, and 258 had less than 1/5 in. (Data from meteorological sub-station located 1/2 mile from the Ng farm, at the edge of the plain, by courtesy of the Malayan Meteorological Service).

3. This is an approximation, calculated as follows: marketing would take the same time regardless of who undertook it, the comparability of the remaining 24 hours of adult female labour and 14 hours of hypothetical adult male labour may perhaps be accounted for by the lesser strength and household duties of the former.

In these clay soils natural subsoil drainage is, for all practical purposes, non-existent: anaerobic conditions commence immediately below the zone of cultivation, and saturation occurs at a depth of 14–17 in.<sup>1</sup> Furthermore, the soil is too compact in its natural state to allow vegetable root ramification. By frequent and careful cultivation, and through the use of raised beds, however, aeration and root ramification are usually maintained at satisfactory levels. Root-drowning occurs after prolonged periods of rain, combined or alternating with continuous high surface humidity and unrelieved by intervening periods of sunlight or wind; it occurs also after unusually intense, short rains. The former condition causes root-drowning because gravity alone, unassisted by evaporation, cannot remove excess water rapidly enough in such circumstances; the latter condition floods the paths, which function also as inter-bed drains, and prevents the normal gravity-flow of water from the beds, thus maintaining a high saturation surface in the cultivated zone. Neither occurs frequently, however, and the annual loss probably does not exceed 15 per cent of yield<sup>2</sup>.

Although the clay soil hinders drainage and makes cultivation difficult, it is valued far above the lighter soils of some other parts of the plain because of its water-retaining properties. For maximum weight increment, and for the prevention of wilting, the vegetables need a soil containing, at all times, sufficient available soil moisture for unimpaired intake. Rainfall alone cannot provide this: hand-watering, roughly equal in gross quantity to an annual rainfall of 36 in.<sup>3</sup>, assists, supplying the deficit in sunny periods. By way of contrast, in lighter soils, drainage is so rapid that the optimum in soil moisture can be maintained only with the greatest difficulty, and with an outlay of effort for watering far in excess of that found on the Ng farm. Furthermore, in such soils, ponds frequently dry out and fertilizers rapidly leach away.

Hand-watering is, as we have seen, the most difficult and time-consuming task on the Ng farm; yet it is an absolute essential for farms of this type, even under the conditions of high and relatively uniform rainfall obtaining in Singapore. This operation appears to be comparable in many ways to sprinkler irrigation, but allows greater control of quantity, force and direction of application, to any portion of a bed. Evidence is not available for determining whether the hand-applied water is equivalent, volume for volume, to rain water. General considerations, however, point to its being considerably more useful. First, the applied water reaches the vegetable roots at times when available soil moisture is well below *field capacity* and when, without such application, soil moisture would rapidly reach *wilting percentage*<sup>4</sup>. Second, rainfall is usually only partly effective: much of it comes in brief, violent showers which spatter off the beds, beat the soil surface into a less-absorbent condition and thus proportionally increase run-off, and often provide more water in gross quantity than is required to bring the soil to field capacity. In lighter rains of long duration, after field capacity has been reached in the beds, the remainder is useless and, since aeration is impaired, even harmful. Third, hand-watering provides a light wash or spray which is readily absorbed into the soil, does not harm tilth or plants, is not sufficient in quantity to allow wasteful run-off, and does not wash away or significantly leach fertilizers. On the other hand, since hand-applied

1. Occasional root-holes, the considerable admixture of foreign matter, and the high level of the farm in relation to normal river-level may account for the mottling and incomplete saturation of the upper foot of soil. Sticky-point occurs at 14–17 in. in most parts of the farm.

2. This figure is based in part on the farmer's estimate that he loses half of two separate crops in a year, roughly 6 per cent of production, in this manner. The figure is then more than doubled to account for frequent small losses.

3. Calculated on the basis of the volume of water contained in watering buckets, the number of loads carried per watering, the number of waterings per day under various conditions, and the number of days in 1952 on which these conditions obtained.

4. "The quantity of water held in well-drained soil shortly after long-continued rains or heavy irrigation is known as the *field capacity*. The *wilting percentage* is the quantity of water still remaining in the soil when plants can no longer get water rapidly enough to maintain growth . . .". W. A. Hutchins, M. R. Lewis and P. A. Ewing, "Irrigation in the United States", in *Soils and Men: Yearbook of Agriculture, 1938* (Washington, D.C., 1938), pp. 700–1.

water comes during sunny periods, evaporation is probably more rapid than is the case with rain; applications are sufficient, however, to thoroughly wet the soil throughout the root-zone. The importance of watering is reflected in the landscape, as well as in the attention devoted to watering in the daily cycle of activities. The farm contains, or shares with its neighbours, four ponds, which are distributed along the edges of the cultivated portion of the farm in such a way as to require a walk, when they all contain water of no more 80 or 90 feet between any plant and the nearest pond<sup>1</sup> (Fig. 1).

The fertility of the Ng farm soil is very low. The original organic content, after 33 years of intensive cultivation, has long since disappeared. River overflow is rare enough at this point to be of no significance as a replenisher of soil nutrients, and, finally, the continuing liberation of plant foods from the clay minerals can provide little nutrition in proportion to the needs of the vegetables.

The total production of cleaned, whole vegetables amounted in 1952 to about 57,000 lb.<sup>2</sup>, the equivalent of some 66 short tons per cultivated acre<sup>3</sup>. Although *choy sam* is 90 per cent water, and although the entire plant is included in the yield figure, nevertheless the Ng farm soils, unassisted, could not provide even a fraction of the plant foods needed for this yield. The chief fertilizer used on this farm is a waste-product, locally termed *prawn dust*, consisting of broken particles of prawns. A total of about 37,500 lb. was applied to the farm in 1952<sup>4</sup>; this is equivalent to an annual application of 44 short tons per cultivated acre<sup>5</sup>. The annual fertility increment from prawn dust is of the order of 2,180 lb. of nitrogen, 1,580 lb. of phosphorous, and 300 lb. of potassium<sup>6</sup>. The only other important additive appears to be lime, about 400 lb. of which are applied annually to the farm. The use of such large quantities of fertilizers is readily understood in this socio-economic setting: the farm level of living depends largely on cash income which, in turn, is a function, at any given price level, of yield; and farming technology has long employed organic fertilizers. Furthermore, natural and induced crop-ecological factors combine to allow the greatest efficiency for the added fertilizers: leaching is minimized, and the maintenance of adequate root aeration, root ramification and soil water by farming practice provides the conditions for maximum utilization by plants of the available nutrients.

### Economy

The Ng farm, like most in the Kallang farming region, is almost completely commercialized. About 96 per cent of production by weight is sold, and almost all products consumed by the farm family or employed in the productive process are purchased with the proceeds from the sale of vegetables<sup>7</sup>. The farming system is, in fact,

1. Perhaps twice yearly all ponds on the Ng farm are dry for a few days at a stretch. Ng Hong, however, is fortunate in having his farm situated near a permanent water-source, which flows into the river on the opposite side; he diverts this water over the river to a temporary pond when all others are dry. The river itself is never used, probably because of the difficulty of carrying water up the banks.

2. As the farmer keeps no records and sells small and varying amounts each day, an estimate of annual yields must necessarily be inaccurate. The figure of 57,000 lb. represents a compromise between two estimates, arrived at by different methods, and varying by one-third. The higher figure was based on the farmer's estimate of average yields per bed; this was felt to be too large by comparison with other farms. The lower figure was arrived at by extrapolation from sales reports (adjusted to include consumption) obtained during thirteen visits over a period of four months; this was felt to be too low, because (1) prices had been much higher during the preceding eight months (2) rainfall was 13 per cent below the year's average during this period, and included a 14-day drought. An intermediate figure was therefore indicated as being most reliable. An adjustment of the lower estimate using a conversion factor based on the rainfall deficit during the four months, and averaging the two resultant estimates, gives the figure of 57,000 lb.

3. Including the area of inter-bed paths.

4. This figure is based on the quantity purchased during the year. An alternative figure based on the farmer's estimate of applications per bed was felt to be unreliable, as the prawn dust is not weighed prior to application.

5. Including the area of inter-bed paths.

6. Data for prawn dust analysis were taken from Milsum and Grist, op. cit., p. 31.

7. The chief exceptions in the case of consumed items are vegetables, eggs and chickens, and in the case of productive materials, *choy sam* seeds.

so highly geared to the growers' price of vegetables and the retail price of prawn dust that success in resource-utilization and the maintenance of farm living levels depend largely on the inter-play of these impinging factors. The Ng family of nine is supported solely on produce from the one-acre farm; and, as we have seen, yields sufficient to provide the family with an adequate income depend on the use of large quantities of purchased fertilizers. The family is thus unable to fall back on a shock-absorber employed elsewhere, that of a shift towards subsistence production in times of poor sales, low prices, or high costs of commercial production.

*Farm receipts* in 1952 amounted to about M\$11,720<sup>1</sup>, and seem to have come entirely from the sale of vegetables<sup>2</sup>; *farm expenses* for the same period totalled about M\$9,150<sup>3</sup>. *Family income*<sup>4</sup> in 1952 was thus about M\$2,570. Since the *value of farm privileges*<sup>5</sup> amounted to very roughly M\$2,100, total real income for the family for this year was about M\$4,670. For each pound of *choy sam* sold in 1952 at an average price of M\$0.26, the cost of production was roughly M\$0.20 (of which M\$0.17 went for prawn dust). Thus M\$0.06, on the average, remained for application to the family budget.

### *Socio-Economic Implications*

It is evident, then, that each additional unit of production would increase family income, but only when the price of prawn dust did not rise, or that of vegetables did not fall considerably in relation to average 1952 prices. However, fertilizer prices rose steadily during 1952 and vegetable prices slumped badly. In November Ng Hong reported that, as matters then stood, his family budget was down to the minimum, he was in danger of increasing his indebtedness, which then stood at about M\$1,000<sup>6</sup>, and—most important for the present analysis—he had no money with which to increase his purchases of fertilizers and thus increase yields. From the standpoint of money costs and returns, the situation at the time of writing is precarious for Ng and most of the Kallang farmers.

With regard to those aspects of resource-utilization which depend on the labour of the farmer and his family rather than on purchased input factors, the situation is not markedly different. One fact emerges from a consideration of the analysis of productive activities: the farmer's, and his family's, labour is used to nearly the fullest extent possible. Additional watering would undoubtedly produce somewhat higher yields, but the farmer and the farm women are unable to devote significantly more time to this activity. Other productive activities take less time and effort. If the farmer felt that production could be increased by devoting more time to any of them, he, or others in the family, could probably do so. Hired farm labour cost roughly M\$6 per day (M\$5 plus two meals) in 1952, and watering appears to be the only task in which it could have been productively employed. However, at 1952 wages and prices, an increase in yield of at least 19 per cent would be needed to cover the cost of hired labour, and it is doubtful whether more efficient watering could bring about such an increase.

1. The Malayan dollar (M\$) is approximately equivalent to £0/2/4 sterling, or U.S.\$0.32.

2. *Choy sam* is calculated to have brought in M\$9,998, *sai yung choy* M\$723, *kan choy* M\$526, *choong* M\$432, and *pak choy* M\$43. Sales of *kang kong* were insignificant.

3. The calculated cost items are as follows: M\$8,175 went for purchase of fertilizers, M\$256 for Ng Hong's share in the hire of a lorry for marketing the vegetables, roughly M\$200 for maintenance of productive equipment and farm structures, M\$340 for purchase of seeds, possibly M\$100 for purchase of pesticides (*Derris elliptica* and "Kadol", a DDT preparation), and M\$78 for rent of the farm land. The figure given for maintenance of equipment and structures must be taken in place of an accounting of depreciation, as the estimates on farm value and depreciation rates were unreliable. In the absence of reliable data, changes in inventory must be assumed to have been nil.

4. *Family Income*, the crude returns after expenses have been subtracted from receipts, does not take into account the rental value of the house or the value of consumed products, and is not differentiated as to returns for the operator's labour, unpaid family labour, capital, etc.

5. The *value of farm privileges* is the rental value of the house plus the value of consumed products.

6. The debt of about M\$1,000 is owed to Ng Hong's fertilizer supplier in Singapore. It is free of interest, and credit will probably not be withdrawn so long as Ng continues to purchase from this supplier.

It appears, then, that internal factors are not likely to alter in the near future in such a way as significantly to improve production and the family's economic circumstances. Water and plant nutrients are the two critical crop-ecological conditions which, because their present supply is less than the optimum, seriously limit production: the former cannot be considerably improved without more hand-watering, the latter without heavier fertilization. Yet the Ng family cannot supply the necessary labour, and neither can it afford to hire extra labour or purchase more prawn dust. Thus, with the knowledge, materials and capital available the family has achieved a certain unstable equilibrium in resource-utilization and production, subject to constantly altering impinging influences, and requiring constant readjustment to meet the changing circumstances.

#### APPLICATIONS

Nearly all Singapore's 4,000 or so farms reflect the same sensitivity to external circumstances as does the Ng farm. Nearly all are highly commercialized, depending on sales of vegetables, pigs, poultry, fruits, etc. for the maintenance of family income, and on purchased input factors for the sustained high production needed to maintain real income. Many, in addition, find field water-supply a serious problem. At present no significant assistance can be said to be available to the farmers. There are no experiment stations, demonstrations farms, marketing or supply schemes, and apparently no formal producers' co-operatives. Thus the farmers, unorganized and unassisted, can do little to modulate the direct effects of external conditions.

An agricultural development programme in this setting can evidently seek to remedy the situation by effecting changes in the impinging economic and environmental conditions, and by improving the farmers' technical knowledge. The formulation and execution of such a programme must be based, however, on adequate prior knowledge of the farming situation and external influences as a whole. Studies which attempt, as does the present one, to throw some light on the material resources, farming technology and production of individual farms, can help to a certain extent to provide this knowledge. Apart from the fact that a single micro-study can be a means of testing and evaluating methods, even an adequately replicated set of micro-studies will have three shortcomings in relation to agricultural development programmes. First, a broad range of cultural processes which are significantly related to, but not directly involved in, production and farming activities, have only been touched on lightly. Second, whereas detailed and accurate information of the sort which can only come from highly intensive agricultural research is essential for many policies, the present type of study can offer only the data obtainable by interviewing, observing and mapping the farm, and studying the environment. And third, our knowledge largely concerns the farm itself: what information we have about external factors is largely limited to what the farmer can tell us.

The cultural processes which have been left untreated in the present analysis appear to have most relevance through introducing the factor of non-economic motivation. It would be incorrect to under-emphasize the importance of the economic factor in Ng farm decisions: that the goal of maximizing real income is primary is borne out by the almost complete commercialization of the farm, coupled with the high degree to which real income is sensitive to the most minute price-changes. On the other hand, non-economic motivation is probably significant enough in relation to the family's value system to render predictions based on assumed "economic" reactions somewhat hazardous. Thus, for example, although an increase in family income will very likely be followed by larger purchases of fertilizers, greater yields, and further increases in family income as a result, it is quite possible that some of the original increase will be diverted to non-productive uses, and some to uses not associated with direct consumption. The family budget may be expanded,

festivals may be more lavishly celebrated, or the ancestors provided with more elaborate offerings. Perhaps most serious and unpredictable is the certainty of a lag in, and the possibility of a complete rejection of, economically "rational" improvements in farming technology or input materials, where such measures require serious changes in practices.

The degree of intensity and detail achieved for the various data on the Ng farm is probably adequate for blocking in the chief needs, critical factors, and likely qualitative responses to planned changes. Precisely what quantitative effects in pounds of yield, dollars in costs or receipts, inches rise or fall of the water-table, or hours-per-day maintenance of soil moisture at field capacity, may be expected to result from such changes, can only be tentatively predicted. Citing fertilizers again as an example, we cannot without careful experiments determine whether the point of diminishing returns has been reached in fertilizer applications; whether, in other words, an additional pound of prawn dust will furnish the same increment of yield as the last one. But we do know that the unit-increment will not, within limits, be significantly less.

These shortcomings limit, but do not eliminate, the applicability of the Ng farm data to agricultural development planning. Assuming adequate replication, so that regional norms and variations can be described, it appears that studies such as the present one can be useful in two distinct ways. First, they can form the basis for planning "models", i.e., constructed situations based on the sum total of predictable changes likely to result from the implementation of a hypothetical policy. Here, the data collected allow us to trace the secondary and tertiary effects of a given change. And second, we can predict, with some degree of confidence, the specific effect of a given change planned or unplanned, on the farm. Since, however specific quantitative effects can be predicted in only certain instances, the constructions will have to be plural, showing limiting conditions and ranges of models rather than single, logically necessary situations. Perhaps the most valuable result of the analysis carried out for the Ng farm is the inference, based on our conclusions concerning the relative insignificance of such factors as credit, marketing costs, etc., and on the present nearness to the optimum in effectiveness of others, such as cultivation practices, use of equipment, etc., that certain policies can have little effect in improving the situation.

By limiting the scale of the present study to a single farm (not a conspicuously small farm by Singapore standards) it has been possible to obtain more detailed data than could have been accumulated by applying the same effort to a larger area. Herein lies the chief justification for the use of this type of study in agricultural development. Data of sufficient intensity and breadth to be useful in predictions can be obtained at relatively low cost, through detailed study of a fraction of a given region in a multiple micro-study programme, based on proper sampling procedures. Furthermore, the data which can be obtained are basic, in the sense that little prior knowledge is required apart from the sorts of maps and meteorological information usually available. Thus, in most tropical areas, where prior information is typically limited, where resources for investigations are also limited, and where needs are greatest, this type of study may have some measure of applicability<sup>1</sup>.

1. For a comprehensive discussion of the place of research in agricultural development planning in under-developed areas see *Formulation and Economic Appraisal of Development Projects*, 2 vols. (United Nations, Lahore, 1951).

# AGRICULTURAL EDUCATION AND RESEARCH IN SOUTH-EAST ASIA

## *Jottings from the Notebook of a Soil Scientist*

By ROBERT L. PENDLETON<sup>1</sup>

It is axiomatic that agricultural colonization of a region should be based upon an adequate knowledge of two things: first the natural advantages of the area for agriculture, and second, the most effective ways of utilizing these resources. Thus, both spontaneous colonization and movements fostered wholly or partly by governments need trained and experienced staff who can provide this information, but a lack of such personnel is today hindering sound progress in all branches of agriculture and forestry. It should, therefore, be worth while considering present-day training in some detail, in order to discover why it yields such poor results. Such a discussion is even more timely in view of the large numbers of foreign students coming annually to the United States for their agricultural training.

In this paper, then, I shall examine two problems: the training of agricultural students for work in South-East Asia, and the facilities for agricultural research in that area. My comments are based on more than thirty years' experience in research, teaching, and administration in India, the Philippines, China, Siam, and Central and South America, where I have worked with nationals trained both locally and in various Western countries. In this connection, I hope that the reader will pardon my references to personal experiences.

### THE PROBLEM

In 1935, in Siam, I visited both the *Haad Yai Agricultural Experiment Station* and the adjacent Normal School which was training teachers for the agricultural schools of the kingdom. What I saw there illustrates the nature of the problem I am about to discuss. Although gardening formed a part of the curriculum, the school garden was a distinct failure. The "housekeeping" was excellent—not a weed to be seen—but the process of levelling had removed some of the surface soil, exposing a poorer sandy subsoil. The few surviving vegetables were poor. Evidently the gardening course followed an American syllabus or text, designed not for Siamese soils, plants and climate, but for those of temperate latitudes. Yet the garden had served one important purpose, for the students had actually done some work with their hands *in their own country*, and had been assigned their grades partly by this means.

In a rubber plantation a few hundred metres distant I came to a swale where the ground was too low and too wet for rubber trees to flourish. The clay soil of this depression had been thrown up into long, rounded ridges, each about 3 metres wide and a metre high, on which vegetables were growing luxuriantly. The contrast with the near-by school garden was astonishing. One of the school-teachers who was acting as my guide explained

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that his students often came to this garden when they had spare time and grew vegetables for sale. On the basis of their home training, these students really knew how to grow vegetables, and were making a success of it.

Among Orientals who attend agricultural colleges in the United States, only the exceptional one is able to make use of his training when he returns to his native land. There are a number of reasons for this. In the first place, in Eastern countries the selection of students for foreign study is necessarily limited to those who have a working knowledge of English or of some other European language. Such candidates are almost invariably city-bred boys, and more often than not, boys with influential political connections. They seldom have any knowledge of the agriculture of their native country, or even familiarity with its rural districts. Second, only infrequently does the Oriental in a Western college have the good fortune to study under a teacher familiar with the agricultural resources or potentialities of the student's homeland. Third, while abroad, the student will have had excellent libraries and laboratories at his disposal. In his native land he often finds an almost complete lack of facilities for experimental work, a meagre library, and no inspiring teacher at hand to guide and encourage him. The best the returned student can usually do is to engage in broad exploratory work which allows no scope for his specialized training. Confronted with pressing practical problems, he often becomes frustrated, resigns and seeks employment elsewhere. But these evils may be ameliorated if the student is a country-bred boy who has acquired some knowledge of representative rural areas in his own country, and especially if he has already had there some experience in his chosen field of agricultural study. Above all, he must appreciate the dignity of labour, even in his native land, and not be afraid to do things with his own hands.

#### THE TRAINING OF AGRICULTURALISTS IN THEIR NATIVE LAND

Informed opinion tends increasingly to believe that agricultural progress in an Oriental country is most rapid when an experienced Western specialist undertakes field work there. To do this satisfactorily he must have some knowledge of the local vernacular; such a specialist should spend at least the first six months of his stay in the country in intensive language study. Only then is he adequately prepared to begin his field work. For this he should have as assistants a group of three to five young nationals, who are not afraid to rough it as they travel about the country. The party can make simple exploratory tests in the field, and collect specimens and gather data from which to construct maps; it can carry out reconnaissance soil surveys, supplemented by samples, especially of problem areas; it can assemble entomological collections, make plant-disease surveys and experiment with simple methods of control. After working with such students in field and laboratory for two or three years, the Western expert is able to select one, or preferably two, of his assistants for advanced study in Europe or America. Two such students in each subject are better than one because there is opportunity for competition between them, and furthermore, it is advisable not to place too great a reliance on any particular individual.

Another important advantage that results from a Western expert working in the field with Oriental assistants is that the specialist acquires at least some idea of local agricultural practices, of the problems of the area, and of their possible solutions. Moreover, reconnaissance surveys often reveal that, owing to some slight differences in technique certain farmers are managing to produce better varieties of crops and livestock. Such knowledge can often be judiciously disseminated even before a fully equipped experimental centre is ready. Moreover, if observations are made and experiments conducted only in the immediate environs of the new station, progress over the country as a whole is correspondingly slow.

In countries such as Siam, where agriculture is but poorly developed, there has been a woeful lack of appropriate teaching materials in the agricultural colleges. By concentrating upon field surveys and studies in his early years abroad, the Western expert can accumulate data for teaching, for the preparation of text-books, and so for sound agricultural education. On the other hand the specialist who devotes the whole of his time and attention to class-room and laboratory teaching in already established government agricultural colleges may actually be performing a disservice to the country. Agricultural teaching without field work may only perpetuate inapplicable methods derived from other regions.

#### FIELD WORK AND CLASS-ROOM STUDY

It is evident then, that Western specialists must be given the opportunity for first-hand field study. It is no less important that their students should receive practical instruction.

An example of less than the best agricultural teaching was that at the Central Luzon Agricultural School, at Muñoz in the Philippines. The principal and some of the more senior members of the Faculty were trained Western agriculturalists, but having only recently arrived from the United States, they knew little about local farming practices. (How could even the most experienced agriculturalist fresh from Iowa be expected competently to supervise work in padi growing?) Most of the students, however, had been bred and born to the soil as the sons of peasant farmers. Moreover, small groups of them in the upper classes were required to live in isolated farmsteads on distant parts of the school farm, where they raised rice and livestock in much the same way as a farmer's family would. Yet, I could not rid myself of the feeling that the students were practising even poorer methods of farming than they would have learned from their parents. While the Muñoz school did in a measure dignify labour, as a farm or as an agricultural school it seemed to fall a great way short of success.

Various Oriental countries have established schools primarily to train students for positions in the public agricultural services. An initial difficulty then arises in that these posts naturally require the holders to be proficient in the official language of the country, which is often *not* their mother tongue. Moreover, while it is necessary to have a cadre of men trained for the regulatory, quarantine and other government services, such students seldom return to the farm. The outstanding example in South-East Asia of an agricultural school whose graduates were prepared exclusively for the farm and almost always did return to the land was the *American Baptist Mission Agricultural School* at Pinyinmana in Burma. Here the curriculum was designed solely to help the peasant to be a better farmer and to live a more worth-while rural life.

In the Philippines the College of Agriculture of the University also did good work. Some of its students obtained the degree of Bachelor of Agriculture, while those who could afford the time and expense studied for a further year for the degree of Bachelor of Science in Agriculture. The curriculum was strenuous and, significantly, included manual work in the fields and in the carpenter's and blacksmith's shops during the summer. In fact, Dean Charles Fuller Baker and his associates insisted that all on the campus should recognize the dignity of labour, and that the students should learn by doing. It was usually in the third year of the bachelor's degree course that the student and his major professor decided upon a mutually acceptable and appropriate problem for a thesis. This was then approved by the Dean and the administration. If the subject was in the field of animal husbandry, for example, the problem might be concerned with the raising of pigs on some new type of feed; if in the field of plant pathology, the study of some pathogen; if in the

field of soils, perhaps a survey of a portion of the near-by tropical forest. After the experimental work had been completed, the thesis had to be written up in approved form, which was read by the Head of the Department, as well as by the Dean. It was then read for English by the Head of the Department of English, so that it would be ready for publication in the College's *Philippine Agriculturalist*. In addition to adding to the knowledge of the subject and putting data and results on record, the thesis work also had the merit of keeping the faculty at work on worth-while research.

One of the biggest hindrances to the accumulation of data for teaching purposes was that members of the Agricultural Faculty were given little opportunity or inducement to study field conditions in other parts of the islands. Although the salary scale was adequate for Filipinos, it was insufficient to allow Westerners to travel at their own expense even within the Philippine Islands. Much less were they able to take refresher holidays in the United States. Moreover, the college had no funds with which to subsidize travel. We were supposed to prepare our students for pioneering in unsettled parts of the Islands, but these were precisely the districts about which we knew least; and only too often we were unable to obtain any information about their soils and other natural resources. There were few roads, and shipping between the islands was expensive as well as inadequate. The Cagayan Valley of North-Eastern Luzon was one of the pioneer regions in which we repeatedly urged our students to settle, but I was unable to see that valley until I had taught my last class at Los Baños. In the entire ten years that I was connected with the college, I had but a single trip of ten days in which to study Philippine soils at college expense. The only areas where I was able to undertake any considerable amount of field work were those where sugar was an important crop. Then my expenses were paid by the sugar firms.

Similarly, professional travel in neighbouring countries in order to compare notes with fellow-workers was seldom possible, although such contacts might have obviated the need for many local experiments. At the College of Agriculture in 1935, for example, belated experiments in the planting and care of the African oil-palm were just beginning. These were directed by a Filipino Faculty member who had taken his doctorate in some aspect of temperate zone agriculture in the central United States, but who had no special knowledge of the oil-palm. Yet in Malaya, only three days steaming across the South China Sea, in that same summer I saw thousands of acres of oil-palm plantations, and tank-cars carrying oil to the ports, whence it was being shipped overseas.

#### SELECTION OF STUDENTS IN THE PHILIPPINES

There were serious deficiencies in the way in which Filipinos were selected for graduate training. From our best and most industrious graduates at Los Baños, we annually selected a few to be student-assistants on our campus. After working for a year or more in this capacity some were selected for overseas *pensionadoships*, that is, they were given government fellowships for study abroad. When they were selected, the nominees pledged themselves to serve the college for at least three years after they had completed their graduate work. Thus, as generally only one *pensionado* was trained for each post in the college, the fortunate student might regard his future as secure irrespective of his scholastic record overseas. Yet in spite of this absence of competition during graduate studies, a considerable proportion of the men trained in this way turned out well. Nevertheless, it would have been better had it not seemed necessary to sponsor and support overseas training by official agencies, for this always implied, and practically always assured, the certainty of a post when the student returned. It would have been better, I believe, to have encouraged study abroad on the student's own initiative, and then have compensated him to some extent for differences in the cost of living overseas.

## RECENT DEVELOPMENTS IN SIAM

For the last three years the author has been working in Siam. Among Oriental countries Siam is outstanding in the proportion of its young men and women who have had opportunities for a Western education. But those who are given scholarships for overseas study tend to seek academic degrees rather than a sound knowledge of agricultural practice. This is only natural for the basic salaries of government service vary according to both the degrees obtained and also the country in which they are bestowed. A bachelor's degree from Great Britain or the United States for example, entitles the holder to a higher salary than does a similar degree from the Philippines.

Unfortunately before foreigners can study for a higher degree in Great Britain or the United States, they are often required to take a number of prerequisite courses, frequently of an undergraduate nature. Not only may this greatly prolong their period of study abroad, but it also requires them to spend a great deal of their time on courses which often bear but little relation to the life and work for which they are training. Then, too, government officials sent abroad for advanced work often fail to return to the posts for which they are supposed to be trained. The Thai Tobacco Monopoly, the Government Distillery, or the commercial firms of Bangkok gladly pay higher salaries to well trained Siamese.

Moreover, during their period of study abroad students often acquire a liking for the bright lights of the City, and if they do return to the Thai Department of Agriculture, they are, almost without exception unwilling to remain long at branch experiment stations, most of which are in isolated localities. The posts of provincial and township agricultural extension officials are too poorly paid ever to attract men with overseas training, or even graduates of Siamese colleges.

One of the most pressing problems is to provide some sort of training for the men holding these poorly paid field-posts in the provinces and townships. Dr. H. H. Love, Emeritus Professor of Plant Breeding at Cornell University, and the author have recently attempted to introduce into Siam methods that have already proved successful in a similar situation in China. Early in 1950 we made plans for an initial short course designed to train extension staff for a plant-breeding and fertilizer experimental programme. The Thai Department of Agriculture deputed more than forty members of its extension staff to take the course, while many of the staffs of the University and of the Central Siamese Experiment Station at Bangkok also attended. The lectures were interpreted, paragraph by paragraph, by competent Siamese who had had some years of graduate work in plant breeding abroad. These Siamese staff members also held quiz sections from time to time so that the students could be drilled on the more difficult points developed in the lectures. Most of the time was devoted to methods of plant breeding and of field-plot experimental technique, and to the statistical analysis of the resulting data. Various types of selection and hybridization were discussed with special reference to rice, and the fertilizers we were using were examined in the light of our knowledge of the soils of Siam. At the close of the course volunteers were requested to make head selections of rice in many widely-scattered localities. The volunteers were briefed as to the types and numbers of heads of rice to be selected from each of a number of fields in their districts, and nearly forty of them did make these selections. The result was that over 100,000 separate head selections were sent in for trial and comparison.

The trainees were also instructed how to lay out, randomize, replicate, and carry through, fertilizer-plot experiments. The programme required a large number of dispersed experiments on the principal soil types of the kingdom, so just before the commencement of the padi-planting season, some of the trainees were given intensive instruction for about ten days in the location and laying out of fertilizer experimental plots, in

the application of the fertilizers, and in the transplanting of the seedlings. When they returned to their posts most of these students initiated appropriate experiments of their own. During the growing season one or more of us visited most of the experiments, so that we could form an independent judgment upon the conditions and the general value of the work.

Three months after starting the experiments, when the indicator padi plants were in mid-growth, the trainees were again called to headquarters for discussions and lectures. Then they travelled as a group to inspect each other's experiments. Mutual discussion among the trainees was far more effective than criticism by their teachers. The students harvested their own plots according to definite procedures, and sent the weights of grain to us at headquarters. In addition, they submitted notes on growing conditions, damage if any, or other abnormal happenings.

In 1952, a second short course for township and provincial agricultural officers was given. This time it lasted for six weeks, so that all the instruction could be given at once without calling in the men a second time. Some of those who had taken the first course also attended the second, and we hoped that many of the better students would be permitted to attend several courses, for Dr. Love had found in China that some of those who were so privileged developed, in the course of a few years, into more competent experimenters than were many of their superiors who had received a specialized training abroad.

In addition to the work outlined above, a statistical laboratory period was added to the curriculum of this second course. Data from the fertilizer and plant-breeding field trials were analysed to determine the validity and significance of the experimental results. By the end of the course the better students, even though they had neither a knowledge of English nor any considerable academic education in Siamese, were measuring the significance of their experiments by means of the analysis of variance. Too often the higher administrative officials considered these provincial and township agricultural officers mere mechanics. Our view, on the other hand, was that, with experienced teachers, these men were capable of professional advancement, and our short courses gave them some incentive to do a really worth-while job.

During the last few years the United States Government has spent a great deal of money on scholarships to allow Siamese to make relatively short trips of four or more months to America. If a considerable portion of the money and effort spent on such trips had been used instead to bring to the East more Western specialists, to give them an opportunity of learning about the local environment, and to help them conduct short courses similar to those described above, then very much more would have been accomplished in the basic fields of agriculture.

The emphasis which I place upon these short courses is not intended to deprecate in any way the work of the more formal type of Western college with its more specialized and advanced research activities. There is, of course, a place for agricultural colleges in the East, but with the scales of pay and allowances which most Oriental governments are willing to give, and with the insistence upon the study of English which such institutions require, progress in the development of scientific farming will for far too long be entirely inadequate to meet the needs of these countries.

#### THE NEED FOR A REGIONAL RESEARCH CENTRE AND CLEARING HOUSE

Dean Baker of the Philippine College of Agriculture, until his death in 1927, continually stressed the need for a centre which would undertake research in the biological sciences and in other disciplines of importance to tropical agriculture and forestry. He

envisaged this as an institute with a relatively small number of high calibre research workers on the permanent staff, but with ample laboratory and office space to accommodate scientists on sabbatical leave and those who from time to time might be officially assigned to the centre. In addition, there would be enough secretaries and translators to cater for both the permanent and the visiting staff. Laboratories and experimental gardens would be prominent features of the establishment, and the library would have as many complete sets as possible of journals and publications relating to the tropics, and particularly to South-East Asia. Such an institute as Baker envisaged would serve both as a research centre and as a clearing-house for information. To this end he stressed its international character and hoped that scientists from other parts of South-East Asia would spend a part of each year there, preferably with their expenses paid. From time to time special conferences or seminars would be held, and such gatherings would be high lights in the professional activities of experts from the surrounding countries. It is to be hoped that the most competent agricultural scientists would soon come to consider it a privilege to be on the staff of such a centre, and that young nationals would be more eager to study there than in Western universities specializing in temperate agriculture.

For many years before World War II there had been facilities in the then Netherlands East Indies for studying plant physiological and pathological problems at the Treub Laboratory in the Botanical Garden at Bogor. In the Caribbean region, after World War I, there was started the *Tropical Plant Research Foundation*. Under the leadership of the late Dr. W. A. Orton this centre started in a promising fashion, but without adequate buildings, and able to attract neither the financial support nor the staff necessary for success, it was dissolved in 1943. Another small-scale variant of Baker's idea is the Biological Station which was founded in the early decades of this century on Barro Colorado Island in the Gatun Lake of Panama. But although this laboratory is situated conveniently near to large ports and world trade routes, yet it is relatively isolated. There are adequate residential quarters, but other facilities are very restricted. There is, for example, no library worthy of the name, no secretarial staff, and very limited research facilities for visiting scientists. More important, perhaps, there is no adequate cadre of permanent scientists who can stimulate, guide and collaborate with visitors, or in other ways give continuity to the scientific work. A third attempt to serve the needs of agricultural research in tropical countries is the *Instituto Inter-Americano de Ciencias Agrícolas*, at Turrialba in Costa Rica. This research and training centre has made commendable progress in spite of very inadequate support, for by no means all the member countries of the Organization of American States (formerly known as the Pan American Union) are as yet supporting the Institute. The bibliographic services, which include abstracting, translating and photostating, have made notable progress, particularly in some of the smaller countries. The facilities for visiting scientists to work at Turrialba, either in the laboratories or in the grounds of the Institute itself, or to use other facilities in the region, continue to develop. This Institute has thus made favourable progress, and its development will be watched with interest. But, as far as the Indo-Malaysian region is concerned, there is not known to be a single truly international agricultural research institute, even on a small scale. Since an increasing proportion of the world's population will almost certainly have to subsist chiefly on rice as its staple food, and since such a large proportion of the soils in humid tropical lowlands are at best of indifferent fertility, certainly the most pressing need in all this region is for an adequate scientific centre which can study the padi plant, its breeding, improvement, fertilization and related problems, particularly the soil factors.

## CONCLUSION

During more than thirty years of endeavour to develop and apply agriculture science to the problems of crop and animal production in South-East Asia and other tropical regions, the writer has learned by experience that it is very seldom possible successfully to introduce either plant or animal varieties or practices from the temperate Occident to the humid low latitudes of the Orient. Nor is it often useful or effective to attempt to utilize Occidental temperate-zone text-books or other educational materials or methods. The seeming incoherence of the discussion presented suggests the changing point of view developed with increasing experience in this difficult field.

For the great majority of agricultural field officers or agricultural extension agents in the several countries, instruction in the class-room, laboratory, and field should be through interpreters, in case the teachers are not proficient in the vernacular. It is a mistake to attempt the farm-school type of education because of the almost insuperable difficulty of teaching students to farm in ways as effective as those they could learn from their fathers on their home farms.

Even though some of the smaller countries could well afford serious research upon problems concerning their principal crops, local governments seldom show a real appreciation of the value of such research, of the type of scientists needed, or of the basic facilities necessary for maintaining such scientific work on an appropriate level. Hence there is a real place for regional research and information centres, internationally supported, along the lines of the Inter-American Institute of Agricultural Sciences at Turrialba. Particularly in such institutions, there is a place for a few highly trained nationals, specializing in the several important fields of study. Better methods and policies of training and employing such scientists are needed. The most pressing need, especially in South-East Asia, is for a really adequate international research institute for the study of all aspects of rice growing and utilization.

## RICE IN SOUTH-EAST ASIA

*At the Seventeenth International Geographical Congress in Washington, D.C., in 1952, a session was devoted to a discussion of world food problems. Contributors to a symposium on this theme included Professors J. de Castro of Brazil, E. H. G. Dobby of Singapore, J. Gentili of Western Australia, G. Kurivan of Madras, T. Schultz of Chicago, L. D. Stamp of London; Drs. W. H. Sebrell and C. Taeuber of U.S.A.; and Mr. Gove Hambidge of the United Nations Food and Agricultural Organization.*

At the symposium PROFESSOR DOBBY said:

IN JOINING this symposium I am surprised to find myself, a non-Asian member of the Congress, as the only speaker on rice and its place today in world food and trade problems. World trade in rice has for some years centred on South-East Asia, a region which, for fifty or so years until 1940, was the one insurance against famine of all rice-eating people in Asia ..... who number about 1,000 million. It has not, of course, fed that number of rice-eaters, but it has served as the only pool of surplus rice upon which they could draw when their own crops were below normal through physical or biotic variations. South-East Asia, and in particular its political units, Burma, Siam and Indo-China, functioned for the monsoon fringe much as the wheat-lands of the Americas and Australia did for the world's wheat-eaters.

Today we can see a transformation taking place. South-East Asia's total rice acreage is about what it was in 1940; its total production of rice is much the same; but its outflow has shrunk to barely half. Among the many reasons for thinking this to be permanent rather than a mere after-effect of war, is the fact that the populations of former rice-exporting countries have greatly increased and must now consume more of their own produce. The drying-up of this source of rice presents a grim prospect for other peoples of the monsoon fringe, of whom there are now eighty million more than there were in 1940. Their food supply at home is less adequate than it was the consequences of a harvest variation are worse because their old insurance in South-East Asia has nearly expired.

Continental South-East Asia is within sight of ceasing to be a source of surplus rice. The demand for what it still has is carrying the price of rice in the international market to heights which before the war would have been though fantastic. Rice is now seven times as costly as in 1940 and the price is still rising. The consequences are felt at the moment chiefly in Asia's urban and industrial areas where the cost of living has risen parallel to the price of rice, causing radical changes in the cost of production of industrial commodities and processed goods. The high costs of its exported rice are beginning to take away from Monsoon Asia in general its asset of cheap labour, and South-East Asia no longer has this in any case.

For reasons more sociological than geographical these high prices for rice in international trade have little effect on the South-East Asian cultivator. They fail to cause him rapidly to expand production. That is one of the lamentable consequences of the horticultural technique he uses to grow wet rice, and of the subsistence mode of farming by which his produce is used mostly for direct eating by him and his family rather than sent to market. South-East Asia's surplus from Burma, Siam and Indo-China was solely from contexts like this ..... from peasants and not from mass producers of the type characteristic of the world's wheat-exporting regions.

Though its new price level does not act as a major inducement to the subsistence farmer, rice now has a value which makes its cultivation a commercial proposition. Mechanized rice farming may now be profitable instead of merely desirable, as it has been so far. At today's prices, rice may even be a better proposition than wheat. On the basis of the average national yields of rice in Burma and of wheat in the United States, and using current commodity prices in Rangoon and Chicago respectively, an acre of rice in Burma yields an average value of U.S. \$51, while the comparable figure for an acre of wheat in the United States is U.S. \$43. To my mind, however, mechanization has prospects only in one environment—that of virgin land and a small cadre of skilled labour. Mechanization is not really feasible for rice-growing in existing areas where the local population cannot in practice be transferred elsewhere or to other employment, but it does offer us the means for developing commercially the lacunae in the present land-use map of monsoon and equatorial lowlands. It offers a way to get a high out-turn per person employed, and thus a real surplus to feed Asia's non-agricultural populations.

The commercial possibilities of rice-growing have already attracted other parts of the world. Territories never before engaged in rice-growing have, over the last decade, taken to it on a large scale. The United States, Brazil, British Guiana, Australia and Egypt now export rice at prices mostly cheaper than those prevailing in Rangoon. Brazil alone has increased its total tonnage of rice production by more than that reported for the whole of Asia for the same decade. Non-Asian countries have trebled their rice production since 1940. They have done so on a commercial and, frequently,

a mechanized basis, untrammelled by traditional methods or by social inertia of the kind present in Asia. They produce on the basis of a high out-put per person employed. Only in that way can we get a true surplus for Asia.

In the traditional rice areas of Asia, there is already pressure on the peasant to improve his yields. I cannot subscribe to the view that Westerners need teach the Asian that. No lesson to a peasant could be so forceful as the extra mouths that appear within his own family year after year, all expecting to be fed from the same rice fields. We underestimate the peasant's interest in rice genetics, and we are apt to overlook his achievements in that direction by trial-and-error methods.

Nor is diversification of crops much of a solution to offer farmers in existing rice-growing areas. The subsistence mode itself provides a major inducement to diversify food production. South-east Asia as a whole has a wide range of crops even if few are commercial. It is useless to reproach Asian peasants for engaging so much in single-crop agriculture when so often the local land, in conjunction with the local climate, leaves him little option. We do not reproach a farmer on the Great Plains of America for concentrating mainly on wheat; he too has a terrain for which one grain appears to be the optimum crop.

As geographers there is one point about South-East Asian rice-growing we must stress. It has so far been concentrated in valley-bottom lands. This has come about by trial-and-error methods, through shifting cultivation and through dry-rice cultivation. The peasant has found the bottom lands to have the best soils, to give sustained returns and to be most reliable in water supply. His wet-agricultural method there gives him its greatest returns with least need for regional planning of drainage or irrigation. The valleys are the optimum rice-growing lands within the engineering limitations of the peasant..... but they deter experiments with other crops and other methods of cultivation. Others parts of the world have not followed the Asian in placing rice on bottom lands. Most of the rice-lands elsewhere are out of the valley bottoms, on terraces or similar higher surfaces of the landscape, where cultivation for rice is much like that for wheat except for a short phase when water is lifted to the fields and is completely under the control of the farmer. In Monsoon Asia, on the other hand, the farmer is at the mercy of his water. That is the cost he pays for his system by which water reaches his fields naturally by direct rainfall or by floods. The extension of rice in South-East Asia has been chiefly by pressing rice into lower and lower levels of the swamp terrains. Probably the Asian peasants' greatest contribution to food growing is this technique of producing from hot, wet, low-lying settings. I am not sure that the West has yet given much evidence of a better technique for dealing with such an environment, though it is one where the area and the potential for development are still great in the equatorial regions.

The rigidity of Asian subsistence farming has already led to the shortages of food being relieved by alternative foodstuffs. Wheat and flour are moving into the Philippines and Indonesia at an unprecedented rate ..... an example of the pressure on padi-fields being converted into a pressure of wheat-lands. Bread is more and more evident in the diet of Asian town and industrial workers; potatoes are being used; corn is on the increase. These solutions by alternatives from outside are of course easiest where Asians are urban and therefore accessible.

We, as geographers, are chiefly concerned with the material changes in Asia's food supplies, and with their implications, but we must not overlook their impact on political geography. Since the international rice trade is now largely handled by government agencies, the problem of Asia's food shortage is one which appears easily to invite political solutions, though we tend to see it as one of tackling new environments. Asians may yet use some form of the war-cry "living-space" in their food procurement. India's desperate need for rice, expressed now by paying three times as much for its food imports as it did in 1950-51, may assume the form of 'acquiring' Burma, the nearest existing rice-surplus country, or determining to try its hand on the vast potential rice-lands of East Sumatra's swamps. Communist China is already pressing into Indo-China with an eye on the rice of Cambodia and Cochin-china. Either China or Japan may yet awaken to the possibilities of solving their food problems in the great, wet deltas of Borneo.

As geographers we should, I think, emphasize that it is an extension of rice into new areas which offers the greatest hope of relieving the problem which is disrupting Asia now. The new price levels make possible a mass attack on the vast empty areas of Borneo and East Sumatra, not by the niggling method of transferring a few small-holders—who can never, I suggest, produce a significant surplus—but by the large-scale method of complete mechanization, aiming at a high return per worker and full commercialization of his produce. We cannot, I submit, do much in the existing areas of rice-growing where the congestion is already a strong inducement to produce and where experiments with novel methods must become involved with intricate social problems. In the great empty spaces of South-East Asia a massive and speedy attack by machines and by the landscape planner is possible, untrammelled by population problems. In this kind of attack the Western technologist and Western landscape planner are in a position to offer a great contribution to Asia's well-being. Similar possibilities suggest themselves in the tropical swamp-lands of the Amazon and the Congo, but their distance from Asian consumers must give them only second priority to Borneo and Sumatra as prospective rice-granaries for the uneasy, rice-eating people of Asia's towns.



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